

Delivering Positive Reminiscence Through a Ubiquitous Device  
Application Designed for People Living with Dementia and  
their Care-givers

Claire Ancient

February 2016

The thesis is submitted in partial fulfilment of the requirements for the award of the  
degree of Doctor of Philosophy of the University of Portsmouth.

## **Abstract**

Dementia is a progressive condition which is synonymous with cognitive decline. In the UK, it is estimated that the number of people living with the condition is 800,000, a figure which is anticipated to rise above 1 million people before 2021. Symptoms of dementia include short-term memory loss, communication problems and difficulties with reasoning. In addition to these symptoms, many people living with dementia experience neuropsychiatric symptoms, including depression and apathy. Positive reminiscence is a non-pharmacological intervention which has the potential to improve the happiness of people living with dementia. Reminiscence utilises prompts, such as music and photographs, to evoke the long-term memories of the person with dementia, a capacity which is the last to be affected by the condition. Generally, reminiscence uses generic prompts, however, there is research suggesting that personalised memories lead to greater engagement in the activity. This research uses a mixed methods approach to develop a theory-based reminiscence program which can be implemented on a tablet computer and evaluate the potential for it to be accepted by people living with dementia and their care-givers. An initial study within this project found that personalised memories which use photographs, stories and music as stimuli are effective at evoking positive emotions in people over the age of 50. The research then develops a set of guidelines which can be used to design technology interaction to ensure that it is dementia friendly. Further research used these two areas of theory which have been developed to design and implement an application to facilitate the reminiscence program. The acceptance this application is then qualitatively assessed using people living with dementia and their informal care-givers. Results suggest there is the potential for the tablet application to be accepted by the target user group. This thesis makes a number of contributions to knowledge including the most effective types of stimuli and memories to evoke positive emotions, guidelines for dementia friendly technology interaction, and the potential for the theory-based reminiscence program implemented on a tablet computer to be accepted by people living with dementia and their care-givers.

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Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The results and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award.

Word Count: 65,278 words

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# ABBREVIATIONS

Notation	Description	Page List
BPS	British Psychological Society	22
BTFG	Beta Test Focus Group	134
CART	Computer Assisted Reminiscence Therapy	129
CIRCA	Computer Interactive Reminiscence and Conversation Aid	129
DLB	dementia with Lewy bodies	98
DSW	Dementia Support Worker	30
EFG	Exploratory Focus Group	134
ET	Extended Testing	156
HCI	Human Computer Interaction	21
LR	life review	54
LRT	life review therapy	54
LSB	life story book	64
MCA	Mental Capacity Act 2005	29

<b>Notation</b>	<b>Description</b>	<b>Page List</b>
NHS	National Health Service	32
NRES	National Research Ethics Service	38
PEOU	Perceived Ease of Use	119
PFG	Prototype Focus Group	134
PU	Perceived Usefulness	119
PwD	person living with dementia	13
PwDs	people living with dementia	6
QoL	quality of life	6
RCN	Royal College of Nursing	27
REC	Research Ethics Committee	32
RFS	Reminiscence Functions Scale	43
RT	reminiscence therapy	41
SES	Socio-Emotional Selectivity Theory	73
SiR	simple reminiscence	54
SpR	spiritual reminiscence	54
TAM	Technology Acceptance Model	119
UX	user experience	97

# DISSEMINATION

## Conference Proceedings

Ancient, C., Good, A., Wilson, C. & Fitch, T. (2013). Can ubiquitous devices utilising reminiscence therapy be used to promote well-being in dementia patients? An exploratory study. In C. Stephanidis & M. Antona (Eds.), *Universal Access in Human-Computer Interaction. Applications and Services for Quality of Life* (pp. 426-435). Berlin: Springer.

Ancient, C. & Good, A. (2013). Issues with designing dementia-friendly interfaces. In C. Stephanidis (Ed.), *HCI International 2013 - Posters Extended Abstracts* (pp 192-196). Berlin: Springer.

Ancient, C. & Good, A. (2014). Considering people living with dementia when designing interfaces. In A. Marcus (Ed.), *Design, User Experience and Usability. User Experience Design Practice* (pp 113-123). Berlin: Springer

## Presentations and Posters

Designing Dementia-Friendly Ubiquitous Applications to Facilitate Reminiscence Therapy - School of Computing Research Seminar Presentation, 20th February 2013.

Exploring the Use of a Mobile Application to Facilitate Reminiscence Therapy in Dementia Patients - Poster Presentation at the School of Computing Conference 2013.

Reminiscence Therapy in Dementia Care - Poster Presentation at the Faculty of Technology Conference 2013.

Benefits of Reminiscence Therapy for People Living with Dementia and their Care-givers - Poster Presentation at the Southern Institute for Health Informatics Conference 2013.

Legal Challenges of Research Involving People Living with Dementia - Poster Presentation at the School of Computing Conference 2014.

Factors to Consider When Designing Dementia Friendly Interfaces - Poster Presentation at the Faculty of Technology Conference 2014.

Factors to Consider When Designing Dementia Friendly Interfaces - Poster Presentation at the Southern Institute for Health Informatics Conference 2014.

Developing a Technology-Supported Intervention Based on Positive Reminiscence with People Living with Dementia - Poster Presentation at the Faculty of Technology Conference 2015.

## **Other Achievements**

Invited organiser and chair for a parallel session entitled "Designing Interfaces for User Groups with Challenging Needs" at Design, User Experience and Usability 2014. Heraklion, Crete, 22nd - 27th June 2014.

Program Board Member of Design, User Experience and Usability 2014. Heraklion, Crete, 22nd - 27th June 2014.

Program Board Member of Design, User Experience and Usability 2015. Los Angeles, California, 2nd - 7th August 2015.

Program Board Member of Design, User Experience and Usability 2016. Toronto, Canada, 17 - 22 July 2016.

Reviewer for Cyberpsychology, Behavior and Social Networking.

# ACKNOWLEDGEMENTS AND DEDICATIONS

Behind every PhD student there is an amazing support network and mine is no different. Without every single one of you I'm not sure I would have got through the past three and a half years.

To my family. From day one you have put up with me. You have been there for me - celebrated the good times and supported me in the bad times. I couldn't have got through the last seven years without you all there. Hopefully now you will get your spare bedroom back and a daughter / sister who can be there for you as much as you have been there for me. I am eternally grateful for the support, understanding, and love you have given me over the years. Hopefully one day I can repay you in kind.

To my Cornish clan. We never see each other for long enough - hopefully I will have more time to see you now! However, despite the distance between us, knowing that I could pick up the phone or get in the car and see you has given me comfort in the darkest of times.

To Amanda. Thank you for putting up with my ranting and whining. Having someone close who had just got through to the other side has been invaluable (and at times, comforting). You have not only supported me through the tough times but been there in the good times too. You will always be my teaching guru and above all one of my closest friends.

To Graham. From the first day of my undergraduate degree you have been there for me. Thank you for listening, all support you have provided, and the early morning coffees!

To Dave Carpenter. Without you I don't think the NHS Ethics would have been such a (relatively)

easy process. Your invaluable advise has provided the grounding for this research.

To Clare and Tineke. Thank you for all the support, advice, and proof reading you have provided me with over the course of this PhD.

Finally, to Alice. You have been the most important part of the past few years. Without your support, encouragement and guidance I couldn't have got to where I am today. I am so excited to see what the future holds for us both. Over the past few years I have watched the dynamic of our relationship change from staff/student, to colleagues and now, hopefully, friends. I don't think I am ever going to be able to repay you for everything you have done for me over the years.



## CHAPTER

# 1

## INTRODUCTION

Dementia is a devastating, progressive condition. It robs people of their most precious memories, and steals loved ones away. By the Prime Minister's own admission, dementia has become a national crisis (Cameron, 2012). It is estimated that approximately 800,000 people are living with dementia in the UK alone (Alzheimer's Society, 2012), with the majority of these people aged 65 and over. With an increasing grey population, this figure is set to rise rapidly. Current estimates state that by 2021 there will be one million people in the UK living with dementia.

### 1.1 Dementia

The World Health Organisation describes dementia as a "public health priority", which causes an extreme impact on those with the condition and on their caregivers and family (World Health Organisation, 2012). Whilst the main symptoms of dementia are memory loss, mood changes and problems with reasoning and communication (Alzheimer's Society, 2012), between 80% and 90% of patients suffer from neuropsychiatric symptoms including depression and apathy (Steinberg et al., 2004). Existing treatments aimed at managing these types of symptoms are mainly pharmacological in nature, which can lead to harmful side-effects (Hsieh et al., 2010). In addition to existing endeavours (such as developing a cure), research should be taking place to investigate alternative non-pharmaceutical methods for mitigating these neuropsychiatric symptoms. This research will investigate the use of a psychosocial intervention in order to manage the neuropsychiatric symptoms of dementia.

Dementia describes a set of symptoms and is most commonly associated with short term memory loss (Alzheimer's Society, 2012). It is an umbrella term which encompasses a number of conditions including Alzheimer's Disease, Vascular dementia and dementia with Lewy bodies. Generally, the symptoms experienced will be initially mild, and will gradually increase in intensity as the condition progresses (Alzheimer's Society, 2012).

Damage to the brain is responsible for causing the symptoms associated with dementia. This damage is either due to diseases within the brain, or damage to the vascular system.

### **1.1.1 Types of Dementia**

There are hundreds of different types of dementia (Alzheimer's Society, 2012). Despite the large number of different variants of dementia, there are four main types: Alzheimer's disease, vascular dementia, dementia with Lewy bodies, and fronto-temporal dementia. Whilst Alzheimer's disease is the most common type of dementia, it is important to recognise that not all types of dementia are due to Alzheimer's disease.

#### **1.1.1.1 Alzheimer's Disease**

Alzheimer's disease is the most common form of dementia. It is a physical disease which affects the brain, causing cells to die. In a brain which has been affected by Alzheimer's disease, amyloid plaques and abnormal neurofibrillary tangles develop, both of which contribute to the degradation of nerve cells. Both plaques and tangles are found within a healthy brain. However, in the case of the plaques, they are normally broken down. The plaques and faulty tangles can often silently develop for years before any symptoms become apparent. A brain which has been affected with Alzheimer's disease will often also have a shortage of the chemical messenger acetylcholine, which impedes the ability for brain cells to communicate with each other.

As with all types of dementia, Alzheimer's disease is progressive. This is compounded by harm caused by the chemical messenger glutamate, which is released in excessive quantities when brain cells are damaged by Alzheimer's disease.

The cerebral cortex of the brain is a thin shell which covers the entire surface of the forebrain (responsible for higher brain functions such as language and memory). Alzheimer's disease causes shrinkage of the cortex. The result of this contraction is damage to the sections of the brain which are responsible for thinking, planning and remembering. In addition to this, the hippocampus (responsible for the formation of new memories) is also damaged by Alzheimer's disease.

The main symptoms of Alzheimer's disease are:

- Memory loss - people with Alzheimer's disease will regularly forget names of people and places, appointments, and recent events.
- Mood swings - these are often due to an increasing feeling of frustration as a result of worsening memory.
- Becoming withdrawn - the person with Alzheimer's disease will often become increasingly withdrawn due to a loss in confidence and a reduction in communication skills.
- Difficulty carrying out everyday activities - this could eventually lead to total dependence on another person to aid the completion of daily tasks.
- Confusion

### 1.1.1.2 Vascular Dementia

Vascular dementia is the second most common form of dementia. It is caused by damage to the brain's vascular system, due to problems in supply of blood to the brain resulting in the death of brain cells. A number of conditions can result in damage to the vascular system including strokes, heart problems, high blood pressure and diabetes. An early diagnosis is preferable, as treatment of the underlying problem may interrupt the progression of vascular dementia.

There are three different types of vascular dementia:

1. Mixed Dementia - this is a combination of both Alzheimer's disease and vascular dementia
2. Subcortical Vascular Dementia - this form of dementia is also known as small vessel disease as the tiny blood vessels that lie deep in the brain are damaged. Often, the symptoms are not always present and may come and go.
3. Stroke-related Dementia - can often form after a series of mini-strokes (multi-infarct dementia) or after an obvious stroke (single infarct dementia).

Vascular dementia follows a stepped progression. This means that the person can remain at a constant level and then suddenly deteriorate rapidly before plateauing again.

The symptoms of vascular dementia are often similar to those of a stroke, including paralysis and physical weakness. The additional symptoms include:

- Visual misperceptions - for example mistaking a rug for a body of water. This can cause distress; however, it may be a result of the surroundings (i.e. poor lighting).
- Memory problems - this may not be the first symptom of vascular dementia.
- Behavioural changes - this could include becoming more obsessive, although this could be a sign that their care needs are not being met.

- Problems with:
  - Concentration
  - Communication
  - Continence
  - Speed of thinking
  - Walking, due to unsteadiness
- Depression and anxiety
- Confusion
- Hallucinations and delusions

#### **1.1.1.3 Dementia with Lewy Bodies**

Dementia with Lewy bodies is caused by tiny spherical protein deposits building up in the brain. These are normally located in the nerve cells and can disrupt the regular functions of the brain. Protein deposits similar to Lewy bodies are also found in the brains of people with Parkinson's disease; therefore, there are similarities in the characteristics of the two conditions.

The symptoms of dementia with Lewy bodies are similar to both Alzheimer's disease and Parkinson's disease. People with this type of dementia may experience visual hallucinations. These hallucinations may diminish if challenged; however, a better course of action would be to provide distractions or reassurance. When it comes to a person who has been diagnosed with dementia with Lewy bodies, it is extremely important to be flexible as symptoms can fluctuate on a regular basis.

Dementia with Lewy bodies is extremely difficult to diagnose and as a result, is often misdiagnosed as either vascular dementia or Alzheimer's disease. This incorrect diagnosis can have devastating consequences if neuroleptics are used to treat the person as the side-effects of this medication are similar to that of Parkinson's disease and in some extreme cases, can cause sudden death.

#### **1.1.1.4 Fronto-Temporal Dementia**

Fronto-temporal dementia is the rarest form of dementia and the most common cause in younger people. It is a more general form of dementia which includes Pick's disease and frontal lobe degeneration. However, all are caused by damage to the frontal or temporal parts of the brain. The frontal lobe is responsible for executive functions such as motivation, regulation of behaviour, emotional responses, the planning of actions and the learning of new tasks. The temporal lobe is predominantly responsible

for memory, with the dominant side dealing with verbal memories (such as names of objects) and the non-dominant side in charge of non-verbal memories (such as faces).

The symptoms of fronto-temporal dementia include:

- Personality and behavioural changes - these changes cannot be controlled by the person with dementia.
- It can make them appear selfish (as the ability to empathise with other people is lost), distracted and aggressive. Behaviour may become inappropriate. However, it is important to remember that these responses cannot be controlled by the person with this type of dementia.
- Language difficulties - people with fronto-temporal dementia often have problems with finding the right word, which can lead to circumlocution (where many words are used to describe a simple thing).
- Change in eating habits - this includes over-eating and developing a taste for sweet foods.

### 1.1.2 Medical Treatments for Dementia

In certain cases, medication can be used to temporarily alleviate the symptoms of dementia for between six months and a year. However, these need to be used with care as in some cases they can make the symptoms worse. In particular, if drugs are prescribed to people with fronto-temporal dementia it can increase aggression. In addition to drugs which are used to minimise the behavioural effects of dementia, there are two main types of medication prescribed to people with Alzheimer's disease:

1. Acetylcholinesterase Inhibitors - these drugs maintain the existing supplies of the chemical messenger acetylcholine by preventing the enzyme acetylcholinesterase from breaking it down. There are currently three different types of inhibitor: galantamine (trade name Reminyl), rivastigmine (trade name Exelon) and donepezil hydrochloride (trade name Aricept).
2. Memantine (trade name Ebixa) - this drug acts as a protection in the brain cells against the effects of the excess glutamate released when cells are damaged by Alzheimer's disease. Ebixa has been shown to stabilise the progression of Alzheimer's disease in some cases. It can be used to maintain the important skills which are lost due to brain cell death as well as reducing aggression and restlessness.

## 1.2 Reminiscence Therapy

Psychosocial interventions can be used as an alternative treatment to drug therapies, thus avoiding the associated side-effects (Cohen-Mansfield, Marx, Dakheel-Ali, Regier, Thein, & Freedman, 2010; Cohen-

Mansfield, Marx, Dakheel-Ali, Regier, & Thein, 2010). There are a number of different psychosocial interventions which can be used to manage the neuropsychiatric symptoms of dementia.

This thesis will focus on reminiscence therapy. Reminiscence therapy aims to evoke discussion of past memories by utilising tangible prompts, including photographs, music and newspaper clippings (Woods, Spector, Jones, Orrell, & Davies, 2005). Research suggests that this is a useful and cost-effective non-pharmacological intervention for people living with dementia (Woods et al., 2005; Hsieh et al., 2010). The reported benefits of this type of activity include enhanced well-being, an improved sense of self and strengthened communication skills (Thorgrimsen, Schweitzer, & Orrell, 2002; Hsieh et al., 2010). Through focussing on the earlier memories and the “reminiscence bump”, which tend to remain intact for longer after a dementia diagnosis, the activity provides failure-free environment for people to confidently discuss past experiences (Thorgrimsen et al., 2002; J. C. C. Chung, 2009).

Within a group environment, reminiscence therapy has the potential to foster relationships and enhance social interaction, therefore, minimising feelings of isolation normally associated with a diagnosis of dementia (W. Zhou et al., 2012). In addition, this type of intervention allows professional care-givers to gain an insight into the early life of the person they are caring for and helps informal carers (such as family members) to reconnect with their loved one (Woods et al., 2005).

Whilst simple reminiscence therapy aims to “enhance positive feelings” (Westerhof, Bohlmeijer, & Webster, 2010, 04), there is little research which informs participants of the most effective memories to achieve this effect. By promoting reminiscence focusing solely on this type of memory, the lasting emotional effects would have a positive impact on the well-being of people living with dementia even once the stimuli causing the emotion is removed (H. Braak & Braak, 1991).

### 1.3 Research Question, Aims and Objectives

Two-thirds of people living with dementia (PwDs) are residing within the community with their informal care-givers (Alzheimer’s Society, 2013). However, despite this, the majority of research which occurs within the field of managing neuropsychiatric symptoms associated with dementia focus on people who are living in permanent residential care. Therefore, it is important to conduct research which aims to improve the quality of life (QoL) of those living within the community. This could not only positively impact the person, but also their informal care-givers too. This research will aim to build on an existing psychosocial intervention in order to develop a method which can be used within the home environment to manage the neuropsychiatric challenges associated with dementia. It has been decided that reminiscence would be the most appropriate psychosocial intervention to implement using technology for use within the home environment.

This research project will aim to develop a reminiscence program which is based on theory, to ensure

that positive emotions are evoked. This reminiscence program will be developed to be implemented on a tablet computer. Subsequently, the research will investigate whether this program has the potential to be accepted by PwDs and their informal care-givers. Therefore, it will aim to answer the following question:

Are people living with dementia and their informal care-givers willing to accept a theory-based reminiscence application designed for tablet computers?

In the pursuit of answering the research question and achieving the project's aim, a number of objectives need to be achieved.

Firstly, the types of stimuli which evoke memories needs to be investigated. To increase the usefulness of the developed program, it should utilise the prompts which are most effective at evoking memories.

*Objective 1: To investigate the types of stimuli which are most effective at evoking memories*

Secondly, the aim of reminiscence in the dementia domain is to increase positive emotions. Therefore, this research needs to investigate the types of memory which can increase positive emotions.

*Objective 2: To investigate the types of memory which are most effective at evoking positive emotions*

Thirdly, as the developed program will be implemented on a tablet computer, an investigation into the interface requirements for older people and those who are living with dementia needs to be completed. This will lead to the development of a set of guidelines which can be used when designing the interface for the program.

*Objective 3: To develop guidelines to inform development of interfaces which are appropriate for PwDs*

Finally, the research needs to investigate the potential acceptance of the developed reminiscence program. Hence, the final objective of this research is to investigate whether the target users are willing to accept the system which was developed during the course of the project.

*Objective 4: To investigate the acceptance of the developed reminiscence program*

This research will take a person-centred approach. PwDs and their informal care-givers will be included throughout the research process. The project will be split into separate studies which initially develop the theory from which the reminiscence program will be built. In chapter 5, objectives one and two will be achieved. Objective three will be achieved in during the study discussed in chapter 6. Finally, chapter 7 will aim to achieve objective 4 and answer the research question.

## 1.4 Contribution to Knowledge

This research will aim to make three contributions to research.

Firstly, the research will identify the key stimuli and memory types which enhance positive reminiscence. This will allow reminiscence program to be tailored towards the most effective stimuli for evoking conversation and encourage the inclusion of memories which will increase feelings of happiness.

Secondly, the research will develop guidelines which can inform the development of an interface which is appropriate for older people and those who are living with dementia. These guidelines will allow designers to ensure their systems are inclusive for people with dementia. This enables and empowers this user group to utilise advances in modern technology which could improve their quality of life.

Finally, the research will develop and test the use of a new model of positive reminiscence to be facilitated on a tablet computer. The acceptance of this implementation will be tested on a small sample, in order to provide proof of concept before further testing can be carried out on a larger sample.

## 1.5 Anticipated Impact

Reminiscence has the potential to have a positive effect on the behavioural challenges associated with dementia (Dempsey et al., 2014; Tadaka & Kanagawa, 2004; Gonzalez, Mayordomo, Torres, Sales, & Melendez, 2015). Through the provision of an intervention based on positive reminiscence which can be facilitated at home, it is hoped that the behavioural symptoms can be managed more effectively. This research will not assess whether the developed program will have a positive influence on the neuropsychiatric symptoms associated with dementia. However, it will assess whether it would be accepted as a possible intervention within the home environment. This acceptance could be considered as a precursor to assessing whether it does have a positive influence on the users.

In achieving the objectives, the optimal types of memory and stimuli for promoting positive reminiscence will be established. The information gained has the potential to have an influence on reminiscence in general, regardless of the intervention method. If the facilitators of reminiscence sessions are aware of the stimuli and memory types which are successful at evoking positive emotions, they can tailor the prompts used to ensure a favourable experience for the participants.

In addition to investigating methods of evoking memories, this research will develop guidelines to inform interface design. These guidelines can be used to support interface designers when producing systems which are to be used by PwDs. As PwDs will also experience the natural ageing process, the guidelines also include a provision for the changes associated with growing older. Therefore, it can be assumed that the guidelines will also be appropriate for this demographic too.



The use of reminiscence is not restricted to the dementia domain. Therefore, the reminiscence program developed has the potential to be adapted and extended for use within other fields. An example of this would be within the mental health domain. Research by Hallford and Mellor (2013) found that reminiscence can be beneficial for people who are living with depression. Therefore, through adapting the stimuli to the most appropriate for the target users, the developed program will also be able to support people with depression to reminisce at home.

## 1.6 Thesis Overview

This thesis will document the research carried out in order to answer the research question. The following chapters will be included:

- Methodology and Research Design - this will discuss the philosophical and methodological approach taken during this research.
- Conducting Ethical Research Involving People Living with Dementia - this will discuss the ethical implications of the chosen research design. The ethical considerations were vitally important within this research project, particularly as PwDs will be included throughout.
- Reminiscence therapy - this chapter will review the literature associated with the chosen intervention, reminiscence therapy.
- The Perception of Memories - building on the knowledge gained during the reminiscence literature review, this chapter will describe a study carried out, intended to obtain the optimal types of stimuli and memory to evoke positive memories.
- The Development of Dementia Friendly Interfaces - this will focus on PwDs requirements for interface design. Both older people and PwDs have specific requirements when it comes to interface development. A structured literature review was conducted to evaluate the needs which need to be considered when designing interfaces.
- Study 3 and 4 - will focus on the development and evaluation of the theory-based reminiscence application.

## CHAPTER

## 2

# METHODOLOGY AND RESEARCH DESIGN

### 2.1 Introduction

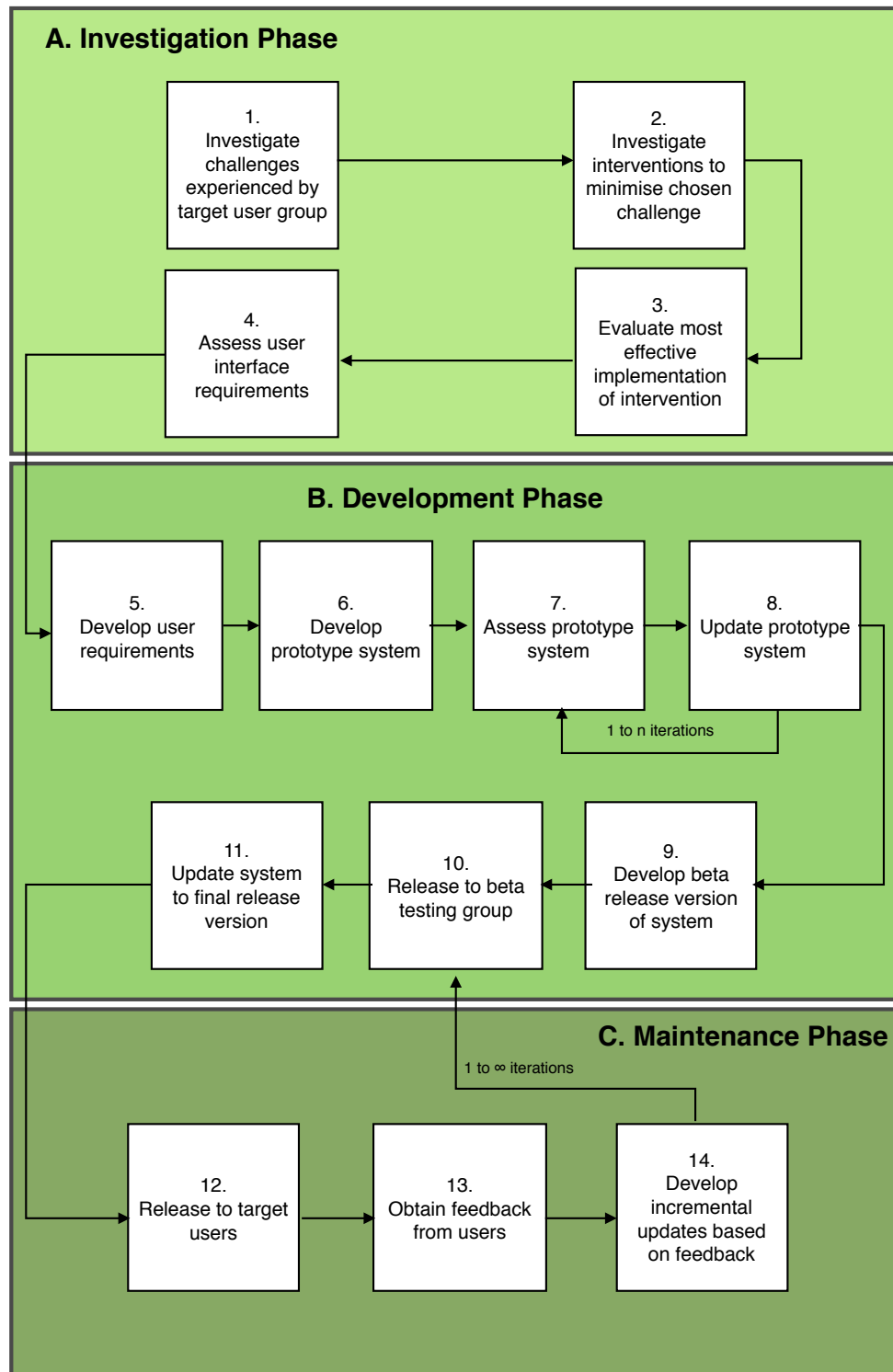
The aim of this research project was to assess the potential acceptance of theory-based reminiscence tablet application by PwDs living in the community and their informal care-givers. The use of a three-phase framework informed both the design of the application and the testing of acceptance. The first phase investigated and developed the theory behind the application. The second phase aimed to focus on the development of the application, with the final stage evaluating the application. Figure 2.1 demonstrates these three phases, and the steps which are involved in each.

The first phase encompassed investigation of the problem. During this phase, both the implementation of reminiscence and the interface requirements was investigated. This covered steps three and four of the framework (the first two steps have been completed within the introduction section). An enquiry into reminiscence allowed the developed application to be effective for the intended user group. Additionally, considering the interface requirements for PwDs aimed to ensure that the initial prototype system was adapted to the potential users in order to avoid exposing them to a partially completed system. This could result in higher acceptance of the final system, as exposure to unfinished technology can discourage adoption within the intended user group (Karlsson, Axelsson, Zingmark, & Savenstedt, 2011).

The development phase is the second part of the research. This utilised user-centred design methodologies in order to build on the results of the earlier investigation phase. Upon completion of this phase, a tablet application was ready to be deployed to potential users in order to assess whether they would be interested in continuing to use the system. Throughout this phase of the research, PwDs and their informal caregivers participated in designing and enhancing the application.

Finally, the maintenance phase was entered. This utilised agile software development methodologies to continually enhance the application based on user feedback. Through developing a system which is maintained using user-centred agile methodologies, the constant evolution of the older population can be accounted for. In this research project, one iteration was carried out. However, recommendations for future improvements to the application are described in chapter 7. Additionally, an evaluation of potential acceptance of the device was incorporated into step 13 of the framework.

Figure 2.1: Diagram demonstrating the framework used to inform the research process



The following sections discuss how this framework was implemented in the form of studies. The research philosophies utilised for the studies are then discussed, with a focus on positivism and interpretivism. Whilst the majority of the research used an interpretivist approach, the initial stages of the investigation phase shown in figure 2.1 incorporated a positivistic study. This is followed up with a broad overview of how the research was designed and conducted. Each stage of this research project was developed to become a stand-alone study, which builds on previous studies, and include their own discussion of the methods implemented. Therefore, this chapter will not discuss the individual methods used by each study. Traditionally, the methodology chapter would also consider the ethical requirements for the research project. Due to the complicated nature of conducting ethical research involving PwDs, this will be considered within a dedicated chapter of this thesis.

## 2.2 Research Framework

The framework used for this research was split into four studies, which all link together to answer the research question and achieve the aims of the project. The investigation phase was split into two studies: one incorporating the intervention evaluation and the other assessing the user interface requirements. The development and maintenance phases each formed their own individual studies.

The first study builds on the knowledge gained during the literature review of reminiscence therapy in chapter 4 to complete step three of the framework in figure 2.1. This study aimed to investigate the stimuli which are most effective at evoking memories in people over the age of 50. Additionally, with the application designed to evoke positive emotions, the initial study evaluated the optimal type of memory to stimulate the desired emotions.

Study two was used to complete step four of the framework utilised within this research project (figure 2.1). It aimed to develop a set of guidelines which can be used to design interfaces for PwDs. Through the development of guidelines, the interface can be initially designed to cater for the unique needs of a person living with dementia (PwD) without exposing them to an unfinished system, thus increasing the likelihood of adoption (Karlsson et al., 2011). These guidelines were not anticipated to be exhaustive, but to provide a starting point for further development of the system.

Results obtained in both studies one and two were built on during the third study. The study used user-centred design methodologies in order to develop the reminiscence application. The study incorporated all the steps included within the development phase of the framework demonstrated in figure 2.1, with potential users involved at all appropriate stages.

The final study involved one iteration of the maintenance phase. The application was released to a small number of target users for an extended period of time. During this study the potential for adoption and future improvements was evaluated. Whilst the suggested improvements will not be implemented

as part of this research project, they will be incorporated into an future release of the application to enable further iterations of the maintenance phase.

## 2.3 Research Philosophy

Not only did this research employ a mixed methods approach, it also had a mixed philosophical approach, with the initial research into developing the theory relating to memories following a positivistic approach and the remainder of the research utilising interpretivism. The following sections discuss the use of positivism and interpretivism within this research project.

### 2.3.1 Positivism

Positivism relies on the reduction of knowledge into statements about empirical observations and the patterns found within them (6 & Bellamy, 2011; Bond & Corner, 2001). When the positivism philosophy is applied, research is approached from a scientific perspective (Sarantakos, 2005). Earlier work by Comte sought to utilise the data gained through positivistic research in order to exert control (Bond & Corner, 2001). However, more recent uses apply any patterns found within the data are projected from the observed into the unobserved with the intention of predicting further observations (6 & Bellamy, 2011).

Traditionally, if a positivistic approach is taken to research, the methods used will be quantitative, with a focus of hypothesis testing (Bond & Corner, 2001; 6 & Bellamy, 2011). This aims to reduce theories based on observations (whether visual or data collected through the use of an instrument) to a set of statements which are testable and allow for generalisation about the patterns we expect to observe (6 & Bellamy, 2011). Bond and Corner (2001) describe the positivistic approach to research as a cyclical process, whereby currently knowledge is tested using hypotheses, which can either be rejected or upheld depending on the data. There is, therefore, a high reliance on research design which focuses on observations, measurement and coding which are more dependable than the theories themselves (6 & Bellamy, 2011). It is also important when conducting positivistic research to ensure the correct instrument is applied (6 & Bellamy, 2011), ensuring that all data is collected in a uniform manner (Bond & Corner, 2001). Additionally, theories must be stated in a manor which allowed them to be tested, and where relevant, disproven (6 & Bellamy, 2011).

One of the main criticisms of positivistic methodologies is the lack of investigation into the causal links of relationships (6 & Bellamy, 2011). This lack of causality can lead to unsatisfactory explanations for the observed data with key questions such as how and why remaining unanswered. In contrast, Halfpenny (2014) suggest the opposite is true with positivism developing knowledge of causal links between variables. However, the research by Halfpenny (2014) suggests that there are at least 12

different strands to positivism, potentially diluting their definition of the philosophy and disallowing any direct comparisons between the authors. 6 and Bellamy (2011) suggests that positivism only considers explanation in the context of it producing predictions of unobserved entities. However, this conflict relating to the knowledge of causal links between variables is not relevant to this research project as the unanswered questions are not required to be answered in order to develop the application. A knowledge of the causal link between variables will not have any impact on the outcomes of the research. Instead, this research will seek to predict the behaviours of a general population with regard to memories.

### 2.3.2 Interpretivism

The interpretivistic philosophy is embedded in social interaction (Houghton, Hunter, & Meskell, 2012). It is argued that in order for data to be effectively analysed, researcher's need to transcend the data and find meaning. This meaning is unique and dependant on the researchers interpretation (Houghton et al., 2012). Therefore, researchers need to be aware of their perceptions and the consequences of them on the results (Houghton et al., 2012). It accepts that there is no unique reality, with multiple truths (Houghton et al., 2012).

The methods which follow an interpretivistic approach to research are qualitative in nature (Houghton et al., 2012; Sarantakos, 2005; 6 & Bellamy, 2011). This allows researchers to develop a deeper understanding of the data (Houghton et al., 2012). Additionally, it ensures that the subjective opinions of the participants are captured and analysed (Houghton et al., 2012). The acceptance of a technology is an inherently subjective variable, with one person willing to adopt new devices whereas others may not. Therefore, as the data is qualitative and based on the subjective opinions of users, following the interpretivism philosophy is appropriate for this research project and aligned with the aims.

A criticism of the interpretivistic approach to research is the non-replicability of the results. This makes validation of results challenging and leads to an inability to generalise to the population as a whole. Additionally, the results obtained are entirely dependant on the subjective information provided by the participants within a social situation (Nandhakumar & Jones, 1997). The data provided within this environment may be subject to censorship by the participants, who may deliberately mislead the researcher or provide a distorted view of reality (Nandhakumar & Jones, 1997). Therefore, in order to avoid the associated negative consequences of this effect, it would be recommended that research is verified where possible using triangulation techniques. Nandhakumar and Jones (1997) also recommend interacting with participants over a longer period of time in order to reduce the researcher/subject barrier, with the intention of obtaining additional insight.

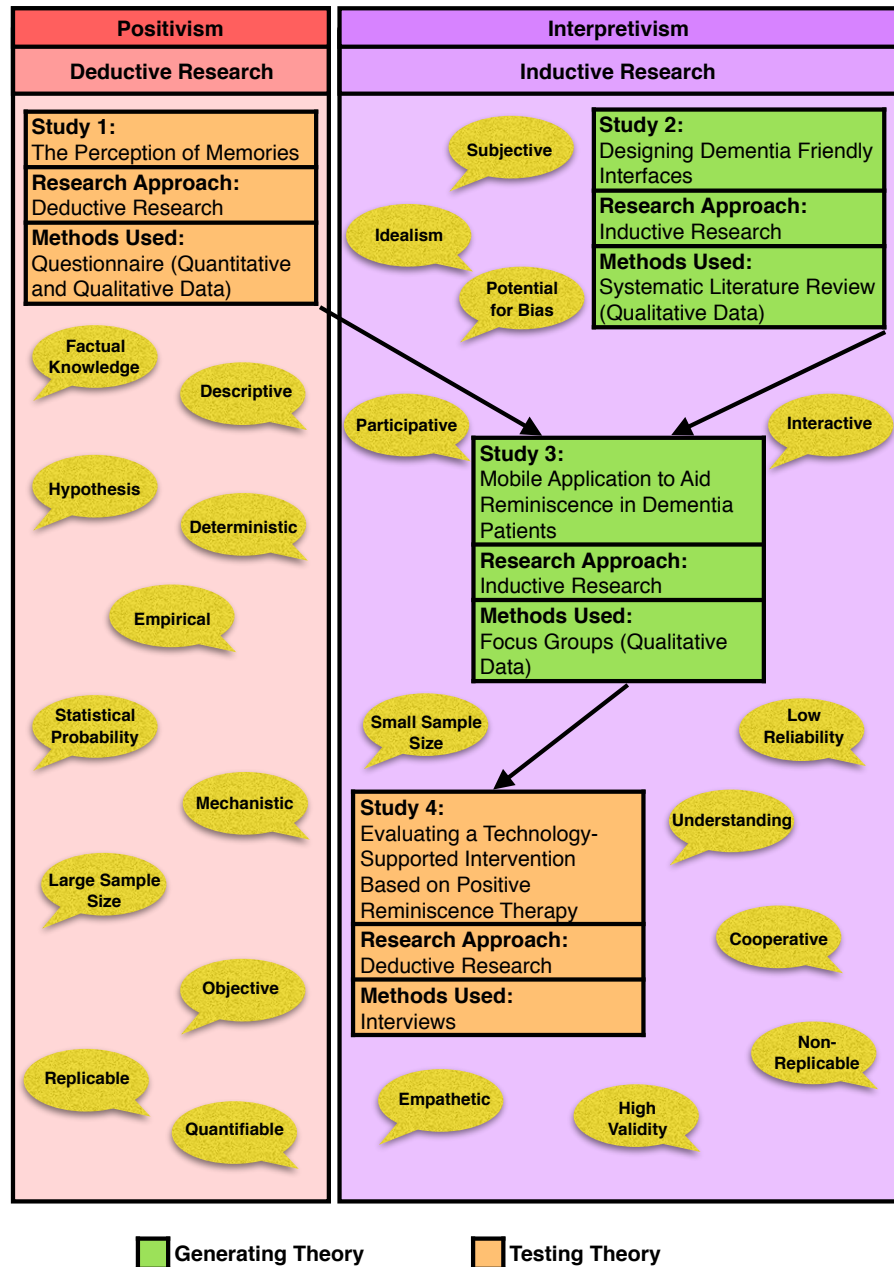
## 2.4 Research Design

The following section will discuss the design of the research, together with an overview of the methods which will be employed. As previously discussed, this research project was split into four studies, each with their own aims and objectives. Thus, this research project employs a mixed methods approach to answering the question posed in the introduction. The third study builds on the knowledge gained during the first two studies. During the final study, the artefact developed in the development phase was evaluated by potential users over an extended period, aiming to carry out one iteration of the maintenance phase, and answer the research question. Figure 2.2 summarises the structure and methods used within the studies. This section only aims to present an overview of the research methods employed as the relevant chapter will include a section which details how the methodology is applied.



Figure 2.2: Diagram demonstrating the research design, with reference to research philosophy

*Are people living with dementia and their informal care-givers willing to accept a theory-based reminiscence application designed for tablet computers?*



Study one approached the research from a positivistic perspective. As such, statistical tests were conducted on data gained through the use of a questionnaire. The study tested hypotheses relating to the objectives of evaluating the optimal stimuli for evoking memories, and the types of memory which should be included to produce positive emotions in the reminiscer. The questionnaire was developed as part of the study and obtained both quantitative and qualitative data. However, the focus of the analysis related to the quantitative data. Future research will analyse the qualitative data using interpretivistic techniques.

The second study utilised secondary research to assess the current knowledge relating to developing interfaces for both PwDs and older people. A systematic literature review was carried out to obtain publications which discuss the interface requirements. Once these publications were obtained and read, a content analysis of relevant sections from within the article was carried out, with a grounded coding system employed. This demonstrated gaps in knowledge which should be considered for future research. Using the quotes obtained from the articles, a set of guidelines were developed to inform the design of user interfaces for older people and those living with dementia.

Building on the knowledge of memories gained in study one and the interface guidelines in study two, study three utilised user-centred design methodologies to develop a tablet application to facilitate positive reminiscence. This study contained four stages: exploratory research, prototype development, software development, and beta testing. The only stage which did not include the users is during software development. All other stages incorporated focus groups or interviews with potential users of the system, with the audio transcribed and a content analysis carried out. During the prototype development stage, users were provided with high fidelity prototypes to evaluate. The beta test stage included potential users taking the application home for a period of one week in order to evaluate it, with a focus group at the end to provide feedback.

The final study involved potential users incorporating use of the application into everyday life for a period of eight weeks. Initially, it was planned that the users would provide feedback in the form of a focus group at the end of the test period. However, due to the complex nature of the users schedule, it was decided that individual interviews would be more advisable. Therefore, each dyad of participants were visited to conduct the end of intervention interview. These interviews were transcribed and a content analysis was conducted. Not only did this study evaluate whether the users would be willing to adopt the technology, it also referred back to the first two studies, to validate the results.

## CHAPTER

# 3

# CONDUCTING ETHICAL RESEARCH INVOLVING PEOPLE LIVING WITH DEMENTIA

## 3.1 Introduction

It is essential that research is conducted in an ethical manner. Due to the nature of dementia, research involving people living with the condition requires careful consideration of both the ethical issues, and legal requirements.

The need to consider ethical issues relating to research is not a new concept. History is littered with examples of research which has been carried out in a manner which would now be considered unethical. Examples such as the Doctors Trial at Nuremberg (Shuster, 1997) and the Tuskegee Syphilis study (Brandt, 1978) have been used to guide the development of principles which are still used today to benchmark ethical practice. It is often the case that ethical issues remain implicit until a conflict leads to them being “brought to the surface” and therefore, becoming explicit (Potocnik, 2013). Legal and ethical issues are inherently intertwined, with ethical issues being broader in nature than the law, which tend to address specific ethical issues which have become explicit (Potocnik, 2013).

A lack of knowledge relating to the ethical issues and legal implications of research can have a detrimental effect on the outcomes, in some cases, acting as a barrier to good research (Monroe, Herr, Mion, & Cowan, 2013). Fisk, Beattie, and Donnelly (2007) go as far to say that the active exclusion of participants who lack capacity is avoidance of the responsibilities associated with conducting ethical research. Whilst it is important to note that researchers do encounter challenges when conducting research involving people living with dementia, these difficulties are not unique to the population. These complications should not discourage the inclusion of people living with dementia in research. On the contrary, as Slaughter, Cole, Jennings, and Reimer (2007) suggest “the challenge is to encourage dementia research to go forward while protecting the rights and interests of individuals with dementia who participate in research”. This chapter will consider the importance of including PwDs in the research process.

There are many ethical and legal issues which need to be considered when conducting research, especially when the participants include PwDs. Monroe et al. (2013) suggest the main issues to consider when involving PwDs in research are: informed consent, recruitment, and surrogate involvement. However, as it will be demonstrated later in this chapter, these are not the only dementia-related issues which need to be considered. This view that recruitment and informed consent are the most important, with no consideration for the potential risks involved aligns with the opinion of Lange, Rogers, and Dodds (2013), who believe that ethics boards spend too much time considering informed consent at the expense of other factors, especially risk. This chapter will consider informed consent, but will also discuss the benefits and risks of participating in this research project.

There are 5 challenges associated with research involving people living with dementia (Monroe et al., 2013). These are determining capacity, surrogate decision making, assessment of risk, potential benefits and measures to increase study understanding (Monroe et al., 2013). Throughout this chapter, these 5 factors will be considered in relation to the research presented in this thesis. Due to the nature of the research, only participants who have the capacity to consent were recruited. As such, surrogate decision making was not concern for this research project. However, an awareness of best interests decision making will be beneficial to the researcher, especially as capacity can fluctuate as a result of dementia.

The remainder of this chapter will look at how research, especially in the technology field, can be ethically conducted involving people living with dementia as participants. The next sections will discuss research involving vulnerable populations and why people living with dementia should be included as research participants. There will be a discussion of the various ethical principles which have been developed over a number of research fields. These guidelines will be synthesised into a definitive list of five principles which will be considered throughout this project. Due to the nature of dementia, there is the potential that participants may not have the capacity to consent to research. As such, there will be a particular focus on the principle of autonomy, which includes both consent and assent to research

participation.

## 3.2 The Importance of Inclusive Dementia Research

## 3.3 The Importance of Inclusive Dementia Research

It is often the case that PwDs are actively excluded from research, in some cases due to conditions dictated by ethics committees (Monroe et al., 2013; Dewing, 2007). However, it is important that this group of users are not prevented from participating in research, which has the potential to be of benefit to them, both at the current time and in the future. Research involving PwDs has the potential to inform best practice to improve well-being and quality of life (Monroe et al., 2013). The exclusion of this demographic may lead to them becoming “therapeutic orphans” by hampering the development of effective treatments (Slaughter et al., 2007) and may lead to increased suffering due to a lack of evidence relating to best practice (Monroe et al., 2013). Additionally, the exclusion of people living with the condition can serve to enforce any negative stereotypes associated with participants lacking capacity as unable to actively contribute to society and research (Slaughter et al., 2007).

PwDs have a unique set of needs, which can only be appreciated by those experiencing the condition (Slaughter et al., 2007). By actively excluding people living with this condition, researchers are missing out on a wealth of insight, which could potentially make services provided more appropriate for the target users. This deficit standard of excluding potential participants due to a dementia diagnosis has lead to gaps in knowledge of treatments and interventions aimed at improving quality of life.

A proxy can be defined as “an ally or confederate who can be relied upon to speak or act in one’s behalf” (“Proxy,” 2015). In some situations, proxies are used as an alternative to including PwDs. However, this will not give researchers a complete perspective on living with dementia, which can only be achieved by including people who have been diagnosed with the condition (Slaughter et al., 2007; Dewing, 2007). This exclusion of people experiencing the effects of the condition first hand leads to information which is inadequate, which has the potential to be harmful to their health care (Lange et al., 2013).

The need to include PwDs is especially true when using Human Computer Interaction (HCI) techniques to develop technologies, where the inclusion of potential users has many benefits including increased rates of adoption (Preece et al., 1994). Through actively excluding this demographic in research which aims to ensure interfaces are accessible to PwDs the developed interaction will be inappropriate.

It is important for researchers to strike a balance between encouraging the participation of people living with dementia in research whilst ensuring their best interests are considered without compromising their rights as an individual (Slaughter et al., 2007). The nature of dementia and other cognitive

impairments makes these groups of potential participants vulnerable to exploitation by investigators carrying out research (Slaughter et al., 2007; Bravo, Paquet, & Dubois, 2003). It can, therefore, be argued that protocols which involve PwDs should be carefully considered in order to ensure adequate additional protections are implemented (Monroe et al., 2013; Slaughter et al., 2007; Bravo et al., 2003). However, a delicate balance must be reached between providing appropriate protections and the unnecessary exclusion of suitable participants, which could deprive them of the benefits associated with the research project (Bravo et al., 2003).

## 3.4 Principles of Ethical Research

There have been various attempts to define principles of ethical research. This has resulted in a number of different sets of guidelines which can be implemented when conducting research. The following section will attempt to synthesise various existing principles with the aim of producing a single framework in which this research can be conducted.

### 3.4.1 Existing Principles

This section will discuss four different sets of guidelines and attempt to synthesise them into one set of principles which will be enforced throughout this research project. It will discuss the Nuremberg Code, the Belmont Report, the principles of biomedical ethics developed by Beauchamp and Childress (1989) and finally, ethical guidelines for research involving human participants developed by the British Psychological Society (BPS).

#### 3.4.1.1 The Nuremberg Code

The Nuremberg code was formulated in 1947 as a result of the Doctors' Trial held as a consequence of the atrocities carried out by physicians in the Nazi concentration camps. 16 of the 23 defendants were found guilty of conducting trials which were torturous and, in some cases, lead to the murder of the participants. The people on whom the research was carried out were prisoners of the concentration camps and had not consented to take part in the research. However, the trial, which lasted 8 months, lead to significant paradigm change in the approach to research participants. The code brought the welfare and empowerment of the participant into the foreground, specifically highlighting the importance of free and informed consent (Shuster, 1997). The Nuremberg Code evolved during the trial, and is now considered to encompass the following 10 principles ("The Nuremberg Code," 2005):

1. The voluntary consent of the human subject is absolutely essential.

2. The experiment should be such as to yield fruitful results for the good of society, unprocurable by other methods or means of study, and not random and unnecessary in nature.
3. The experiment should be so designed and based on the results of animal experimentation and a knowledge of the natural history of the disease or other problem under study, that the anticipated results will justify the performance of the experiment
4. The experiment should be so conducted as to avoid all unnecessary physical and mental suffering and injury.
5. No experiment should be conducted, where there is an *a priori* reason to believe that death or disabling injury will occur; except, perhaps, in those experiments where the experimental physicians also serve as subjects.
6. The degree of risk to be taken should never exceed that determined by the humanitarian importance of the problem to be solved by the experiment.
7. Proper preparations should be made and adequate facilities provided to protect the experimental subject against even remote possibilities of injury, disability, or death.
8. The experiment should be conducted only by scientifically qualified persons. The highest degree of skill and care should be required through all stages of the experiment of those who conduct or engage in the experiment
9. During the course of the experiment, the human subject should be at liberty to bring the experiment to an end, if he has reached the physical or mental state, where continuation of the experiment seemed to him to be impossible.
10. During the course of the experiment, the scientist in charge must be prepared to terminate the experiment at any stage, if he has probable cause to believe, in the exercise of the good faith, superior skill and careful judgement required of him, that a continuation of the experiment is likely to result in injury, disability, or death to the experimental subject.

#### 3.4.1.2 The Belmont Report

In 1978, the Belmont Report was published by the National Commission for the Protection of Human Subjects in Biomedical and Behavioural Research. This was in part due to the public outcry resulting from the press publication of the Syphilis study conducted in Macon County, Alabama (Brandt, 1978; for the Protection of Human Subjects of Biomedical & Research [NCPHSBBR], 1979). The Belmont Report defines three principles of ethical research (Cassell, 2000; NCPHSBBR, 1979):

1. Respect for persons
2. Beneficence

### 3. Justice

The principle of respect for persons encompasses ensuring a person is treated as an autonomous agent, with freedom of choice, and protecting potential participants who have diminished autonomy (Cassell, 2000; NCPHSBBR, 1979). In the Belmont Report, beneficence is defined as maximising possible benefits whilst providing protection from harm, and “making efforts to secure their well-being” (NCPHSBBR, 1979). Finally, the principle of justice aims to distribute the both the benefits and burden of research participation across the group being studied (NCPHSBBR, 1979; Cassell, 2000).

#### 3.4.1.3 Principles of Biomedical Ethics

In the biomedical field, the principles defined by Beauchamp and Childress (1989) are widely used as a guidelines. Beauchamp and Childress developed four main principles:

1. Respect for autonomy
2. Beneficence
3. Non-maleficence
4. Justice

Respect for autonomy is defined as treating participants in a manner which allows them to act freely in accordance with their own self-chosen plan. The obligation to not intentionally inflict harm on people is defined as non-maleficence, whilst the obligation to ensure actions benefit others is beneficence. Finally, Beauchamp and Childress (1989) define justice as ensuring all people who are considered equals are treated as such.

#### 3.4.1.4 The British Psychological Society Code of Human Research Ethics

The BPS have also developed their own code of practice for people working with human participants not only as part of furthering knowledge in the psychology field, but is also “intended to cover all research with human participants” (The British Psychological Society [BPS], 2014). This encompasses four distinct principles (BPS, 2014):

1. Respect for the autonomy and dignity of persons
2. Scientific value
3. Social responsibility
4. Maximising benefit and minimising harm

The principle of respecting autonomy and dignity ensures the researchers are duty bound to the participants. The researchers need to recognise ability for participants to make their own decisions, whilst



ensuring their privacy, confidentiality and dignity are maintained. Consideration for scientific value aims to ensure any studies conducted are of a high quality and scholarly robust. The social responsibility element aims to promote research which is designed to “contribute to the ‘common good’” (BPS, 2014). In accordance with all other principles considered during this section, there is also a provision to ensure that participants are protected from harm and exposed to benefits (BPS, 2014).

## 3.4.1.5 Comparison of Existing Principles

Table 3.1: Ethics Principle Comparison

Beauchamp & Childress	Nuremberg Code		Belmont Report	BPS Code of Human Research Ethics
Respect for autonomy	1	The voluntary consent of the human subject is absolutely essential.	Respect for persons	Respect for autonomy and dignity
	9	During the course of the experiment, the human subject should be at liberty to bring the experiment to an end, if he has reached the physical or mental state, where continuation of the experiment seemed to him to be impossible.		
Beneficence	2	The experiment should be such as to yield fruitful results for the good of society, unprocurable by other methods or means of study, and not random and unnecessary in nature.	Beneficence	Maximising Benefit and Minimising Harm
	3	The experiment should be so designed and based on the results of animal experimentation and a knowledge of the natural history of the disease or other problem under study, that the anticipated results will justify the performance of the experiment.		
Non-maleficence	4	The experiment should be so conducted as to avoid all unnecessary physical and mental suffering and injury.		
	5	No experiment should be conducted, where there is an <i>apriori</i> reason to believe that death or disabling injury will occur; except, perhaps, in those experiments where the experimental physicians also serve as subjects.		
	6	The degree of risk to be taken should never exceed that determined by the humanitarian importance of the problem to be solved by the experiment.		
	7	Proper preparations should be made and adequate facilities provided to protect the experimental subject against even remote possibilities of injury, disability, or death.		
	10	During the course of the experiment, the scientist in charge must be prepared to terminate the experiment at any stage, if he has probable cause to believe, in the exercise of the good faith, superior skill and careful judgement required of him, that a continuation of the experiment is likely to result in injury, disability, or death to the experimental subject.		
Justice			Justice	Social Responsibility
	8	The experiment should be conducted only by scientifically qualified persons. The highest degree of skill and care should be required through all stages of the experiment of those who conduct or engage in the experiment.		Scientific Value

Both the Belmont Report and the BPS Code of Human Research Ethics combine the principles of beneficence. However, whilst these two are inherently linked, they should be considered as separate items. Beauchamp and Childress (1989) posit that by combining these two principles the relevant distinctions between them are obscured.

With the exception of the BPS Code of Human Research Ethics, the focus of the discussed guidelines is medical research. However, it can be argued that the five overriding principles of autonomy and dignity, beneficence, non-maleficence, justice and scientific value have a place within research as a whole. Humans have a basic right to respect for their autonomous decisions. Any research has the potential to have an impact on the participants, however, small that impact may be and as such, researchers should be mindful of this fact. It is the researchers responsibility to ensure that participants experience the minimum amount of harm possible, whilst maximising the potential for benefits. Another important aspect of research is to ensure that people are treated equally. Finally, it is the responsibility of the researcher to ensure that anything carried out is scientifically valid, reducing exposure of participants to interventions which may offer no scientific benefit now or in the future.

### **3.4.2 Respect for Dignity and Autonomy**

The concept of autonomy is one which is included within all four of the guidelines discussed earlier in the chapter. Generally, autonomy is defined as the ability for a person to make decisions, essentially, the ability to self-govern (Beauchamp & Childress, 1989). Autonomy is described by V. Williams et al. (2014) as fundamental. However, particularly in research involving vulnerable people, it is important to ensure this fundamental right to autonomy is balanced against the need to protect the participant (Fisk et al., 2007).

Beauchamp and Childress (1989) are careful to draw a distinction between being autonomous and ensuring that a person's autonomy is respected. They define respect for autonomy as "to acknowledge [...] a person's right to hold views, to make choices and to take actions based on personal values and beliefs" (Beauchamp & Childress, 1989). This is an important point when involving people living with dementia. As will be discussed later in this section (see section 3.4.2.1.1), people living with dementia may not have the capacity to make autonomous decisions. However, this recognition of a person's right to have views, leads to the need to consider a person's assent to participate in research.

The Royal College of Nursing (RCN) define dignified treatment as "to treat them as being of worth, in a way that is respectful of them as valued individuals" (Royal College of Nursing [RCN], n.d.). The respect of a person's dignity ensures that every participant is seen as an individual who has freedom to act (Randers & Mattiasson, 2004). Dignity is a concept which is either respected or violated, but cannot be destroyed or taken away (Randers & Mattiasson, 2004). It is important that researchers respect the dignity of all the participants, regardless of whether they have any impairments.

When involving PwDs in research, the most difficult issue encountered is the concepts of consent and assent (Dewing, 2007). It is argued by Monroe et al. (2013) that when the participants of a research project are living with dementia, both surrogate consent and subject assent are required. However, it could be argued that if the capacity of the PwD remains intact, routinely obtaining surrogate consent or, in the case of research conducted in England and Wales, consultee opinion would violate the person's autonomy. In the case of a PwD who does lack the required capacity to consent to research participation, surrogate consent or a consultee opinion would be appropriate. However, regardless of capacity, the person's dignity would remain, and should be respected. As such, the person's dissent to participate should be respected (as discussed further in section 3.4.2.2) regardless of the decisions made on their behalf. The next sections discuss the various requirements of both consent and assent. Whilst this project will not include people who lack the capacity to consent to research, it will be running over an eight week period, during which time, the capacity of the PwDs may fluctuate. Therefore, consent was obtained prior to commencement of the research study and ongoing assent was ensured throughout the project.

#### **3.4.2.1 Consent**

The need to obtain free and informed consent is an issue which is highlighted in all the four sets of ethical principles discussed in this chapter. Valid consent is defined as being informed, competent and not unduly influenced (Potocnik, 2013; Slaughter et al., 2007; Bravo et al., 2003). It is advised that this consent is obtained in writing after a full consultation with the participants (Murray, 2013; Dewing, 2007). However, the BPS advise that whilst written consent is the traditional method, other methods such as audio-recorded or implied consent may be more appropriate for the context (BPS, 2014). In the case of this research project, written consent was obtained during studies 3 and 4, where face-to-face interventions involving people living with dementia was conducted. Implied consent was obtained from the participants during the first study, with the completion and submission of the questionnaire implying that the participant is willing to contribute.

Consent is often referred to as informed consent, emphasising the need for participants to be aware of and understand the aims of the research, the potential benefits and the possible consequences of their inclusion in the project. This information should be transparently disclosed by the physician or the researcher for the comprehension of the participants (Potocnik, 2013). In the case of this research project, during the initial study, which utilises a questionnaire, there will be an information sheet contained on the cover page. During the final studies, which aim to develop and test the positive reminiscence intervention, participants will be provided with an information sheet (see appendix A, sections A.3.1.1, A.3.1.2, A.3.1.3 and A.4.1) detailing the pertinent information. Another important aspect of consent is to ensure the participants have enough time to consider their participation (BPS, 2014). Therefore, the participants will be given a week to read the information sheet, digest the contents

and make an informed decision with regards to their participation.

The principle of autonomy stresses the importance of a person's ability to "self-govern" (Beauchamp & Childress, 1989). As such, any participation in research should be entirely voluntary. The nature of voluntariness ensures that participants are able to make independent decisions without experiencing coercion, persuasion and manipulation (Beauchamp & Childress, 1989). With regard to this research project, the participants were drawn from the Alzheimer's Society Winchester Office, where the researcher has volunteered for a number of years. Whilst this has the potential for participants to feel coerced into participation, it also allowed the researcher to have previous knowledge of the participants, which aided in deciding whether the PwD lacked the capacity to consent to take part. It was made clear to the participants that the researcher was there in a professional capacity rather than as a volunteer and that refusing to participate would not affect the way they are treated at the groups they attend. In addition, when the researcher was attending in a professional capacity an ID badge was worn to demonstrate the affiliation with the University of Portsmouth. These previous interactions were declared to the Alzheimer's Society upon application for permission to involve service users in the research project (see appendix A, section A.3.3.2 for more information).

In addition to this voluntariness, participants should have the ability to withdraw their participation at any point in the research process (Fisk et al., 2007). During the study involving the questionnaire, the lack of submission of the completed form was considered as the participants withdrawing from participation in the project. Throughout the studies which involved direct contact with the participants, they were informed both verbally and through the use of an information sheet that the possibility of withdrawal from the study was available to them at all points within the course of the interventions.

The nature of a condition such as dementia can often lead to people lacking the required capacity to consent to interventions. When conducting studies which involves people living with dementia, there needs to be careful consideration of the participants capacity to consent to research participation. In England and Wales, people who lack capacity are protected by the Mental Capacity Act 2005 (MCA). The following sections will consider capacity and the MCA together with their implications for involving people living with dementia in research.

#### *3.4.2.1.1 Capacity*

Due to the nature of dementia, the question of whether a PwD is competent is often encountered (Potocnik, 2013). Competence is defined as "the ability to make informed, autonomous decisions and to take the necessary action to put these decisions into effect" (Potocnik, 2013). Mental capacity is perceived as a continuous quality, which can be experienced to a greater or lesser extent (Buchanan, 2004). However, as Buchanan (2004) highlights, legal competence is a discrete quality, you are either considered to be legally competent or not. Those who are considered to be legally competent, are

entitled to have their wishes respected. In contrast, those who are not legally competent are not entitled, by law, to have their treatment wishes respected (Buchanan, 2004). As dementia progresses, the PwD is less likely to be considered legally competent (Fisk et al., 2007), with the gravity of the situation being considered when deciding competence (Buchanan, 2004). Whilst there is research which investigates whether a person has the capacity to consent to treatments, there is much less relating to a person's competence to consent and participate in research activities (Fisk et al., 2007). Additionally, it is suggested by Murray (2013), that capacity and consent should be considered holistically rather than as separate components. With the proportion of PwDs worldwide growing, it is important to ensure these two constructs are considered thoroughly. This will ensure that any studies carried out with the aim of understanding dementia and improving the lives of those living with the condition utilises participants who fully understand the benefits, consequences, and process of the research project.

Whilst there is no formal definition of lacking capacity (Monroe et al., 2013), there are a set of points which should be considered when determining if a person retains the capacity to make decisions (Murray, 2013). These are:

1. Does the person **understand** the information?
2. Can the person **retain** the information long enough to make the decision?
3. Can the person **weigh up** the information to make a decision?
4. Can the person **communicate** their decision?

As a person's dementia worsens, their ability to make free and informed decisions becomes increasingly diminished (Monroe et al., 2013). However, it is important to highlight that capacity is not something which can be assumed (Monroe et al., 2013). Additionally, a diagnosis of dementia does not automatically imply that the person lacks capacity (Potocnik, 2013; Fisk et al., 2007). Therefore, people should be considered capable to make decisions unless it is proven otherwise (Monroe et al., 2013; Potocnik, 2013), with assessments only being conducted if there is cause to question a person's capacity (V. Williams et al., 2014). Many researchers and practitioners are concerned that decisions of whether a person lacks the capacity to consent is often made based on "gut decisions" (V. Williams et al., 2014). In the study conducted by V. Williams et al. (2014), participants would prefer to arrive at a consensus relating to capacity, or through deferring to other parties, often those who know the person better. In this study, the researcher had previous contact with all participants over a sustained period of time, and would gain an opinion from the Dementia Support Worker (DSW) who provides on-going support to the couple.

Capacity is a non-unitary, task-specific construct (Potocnik, 2013; Fisk et al., 2007). Competence is, therefore, relative to the decision which needs to be made (Potocnik, 2013; Buchanan, 2004), with some people retaining the capacity to consent to particular aspects, whilst losing it for others

(Fisk et al., 2007). Furthermore, capacity required is directly related to the gravity of the decision to be made, with more serious consequences having a larger threshold (Buchanan, 2004). As a result of raising the threshold of competence, more people will be incorrectly determined to lack capacity, which could result in harm as a direct result of not respecting a person's wishes (Buchanan, 2004). It is also vital to recognise that capacity will also fluctuate over time, particularly for those living with dementia (Fisk et al., 2007). As a direct result of this, PwDs may experience times where their capacity to consent may be diminished. It is therefore, suggested by Slaughter et al. (2007), that researchers try to postpone their research until such time that the person does retain capacity, taking care not to harass potential participants. This will allow practitioners to take advantage of any lucid moments (Randers & Mattiasson, 2004), thus empowering the person to make autonomous decisions. Additionally, researchers should ensure on-going consent to participate. In this research project, on-going consent will be required. Participants will be required to give initial consent through the use of written forms. The participants use of the system will be a sign of on-going consent to participate in the research. However, the researcher will, additionally, confirm consent at each intervention.

#### 3.4.2.1.2 *The Mental Capacity Act 2005*

The MCA is a piece of legislation which was passed by the UK government in 2005, with the aim of protecting people who lack the capacity to make decisions and those who care for them (Department for Constitutional Affairs, 2007; V. Williams et al., 2014). It is seen as "person-centred" (V. Williams et al., 2014), which attempts to provide protection for those who cannot protect themselves (Bravo et al., 2003). The act provides a framework to assess capacity and support decisions which are made by surrogates in the best interests of a person who is deemed to lack capacity (V. Williams et al., 2014). Additionally, the act sets out who can undertake the role of a person's surrogate decision maker, and the circumstances surrounding this appointment (Murray, 2013). Despite being passed in 2005, the act did not come into force until April 2007 ("Assessing Mental Capacity - BPS Guidelines Published," 2006). In addition, this legislation is only applicable to people over the age of 16 living within England and Wales, as Scotland have their own laws for these circumstances (Department for Constitutional Affairs, 2007).

The Act sets out five principles which must be applied (Department for Constitutional Affairs, 2007):

1. A person must be assumed to have capacity unless it is established that he lacks capacity.
2. A person is not to be treated as unable to make a decision unless all practicable steps to help him do so have been taken without success.
3. A person is not to be treated as unable to make a decision merely because he makes an unwise decision.

4. An act done, or decision made, under this Act for or on behalf of a person who lacks capacity must be done, or made, in his best interests.
5. Before the act is done, or the decision is made, regards must be had to whether the purpose for which it is needed can be effectively achieved in a way which is less restrictive of the person's rights and freedom of action.

In addition, the Act defines that people who lack capacity are unable to make decisions as a result of "an impairment of, or disturbance in the functioning of, the mind or brain" (Department for Constitutional Affairs, 2007). However, as previously discussed in section 3.4.2.1.1, a diagnosis of dementia does not immediately imply that the person lacks capacity. On the contrary, people can live with capacity despite the diagnosis for some time, depending on the rate of their progression. In addition, the situational notion of capacity means that people with dementia may retain capacity to make certain decisions despite losing the capacity for other aspects.

It is a legal requirement of the MCA to ensure that the person is not considered to lack capacity until "all practicable steps have been taken" to support them to make a decision without success (Department for Constitutional Affairs, 2007; Murray, 2013). This may involve using a consent process which is modified to take into account the special needs of potential participants (Dewing, 2007). For PwDs this could mean that simplifying text and utilising images may improve understanding (Monroe et al., 2013). Additionally, using terms which are familiar to the participants can increase the likelihood of understanding (Murray, 2013; Monroe et al., 2013). This is particularly important for research which utilises technology and involves older participants, as the field regularly uses terminology which may not be familiar (Wandke, Michael, & Sonksen, 2012; Castilla et al., 2013; Or & Tao, 2012; Papa, Sapio, & Pelagalli, 2012; Burns, Jones, Iverson, & Caputi, 2013; Ancient & Good, 2013). Whilst it is important to ensure that the PwD is the centre of the decision process, it may be useful to include relatives or close friends to aid in the understanding of the research (Murray, 2013). Only once all avenues have been explored to support a person making an informed decision, can an assessment of capacity be conducted (Murray, 2013). This legal requirement to ensure that the PwD has been afforded all the opportunities to maintain their autonomy, which is a clear alignment between the MCA and the concept of autonomy.

The challenges associated with ensuring the MCA is adhered to is often cited as a barrier to research involving PwDs (Murray, 2013). However, the code of practice has provided researchers with a summary of the rules provided by the MCA which cover research (Department for Constitutional Affairs, 2007). The act states that all research which involves people who lack capacity must be reviewed by an "appropriate body" (Department for Constitutional Affairs, 2007). In England, there are two appropriate bodies, the Social Care Research Ethics Committee (REC) and the National Health Service (NHS) REC, with university boards not providing sufficient scrutiny to offer opinions on research conducted under



the MCA (Murray, 2013). In this research, it was initially believed that a review under the MCA was required for studies 1, 3 and 4. However, upon applying for an opinion on study 3, the NHS REC decided that due to the nature of the research, involvement of people lacking capacity was not required, particularly as communication skills would be needed to make a contribution. Subsequently, studies 1 and 4 were ethically reviewed by the Faculty of Technology REC at the University of Portsmouth.

### 3.4.2.2 Assent

Assent is defined as a person's initial and ongoing willingness to participate in research (Slaughter et al., 2007). According to Fisk et al. (2007), it is usually required, particularly when the person lacks the required capacity to consent. This would coincide with the need to consider the participant's dignity. In addition, they argue that regardless of whether proxy consent is obtained, ongoing assent is a vital requirement.

Subject dissent indicates that a participant no longer wishes to be included within the study. It is contended that research with a high potential benefit to risk ratio, which will only be obtained through continued participation in the study, should continue despite subject dissent (Slaughter et al., 2007). However, in all other cases, any subject dissent should result in an immediate withdrawal from the project or suspension of the study protocol, as dissent can be equated to a refusal to participate in the project (Monroe et al., 2013; Slaughter et al., 2007). This need to respect the participants dissent stems from the fact that the consequences of refusal are different from those of agreeing to participate, with all participants maintaining the capacity to refuse, but not to agree to participate (Buchanan, 2004).

For a person who maintains the ability to communicate, subject assent should be respected, regardless of the opinions of the surrogate decision maker (Monroe et al., 2013). However, researchers need to be aware that communication of dissent may not be through traditional verbal methods, but may be indicated through changes in behaviour (such as increased agitation, or aggression), through a demonstration of feelings of distress or through a lack of co-operation with the study processes (Slaughter et al., 2007). Therefore, it is important that the person taking consent and assent is sensitive to subtle changes displayed by the PwD which may indicate a lack of assent to continued participation in the research project.

Whilst this project did not include any participants who lack the capacity to consent, participant assent to participate in the research was enforced. For the majority of the development of the application the participants consented to a single hour session, with consent obtained at the beginning of the session. Throughout the hour session any signs of dissent was monitored by the researcher and the supervising dementia support worker, however, dissent is not expected to be an issue in these interventions. For both the beta and extended testing sessions, continued use of the application was seen as a maintenance of

assent to participate in the research. If the PwD appeared to dissent to participation during any focus group or interview session, their participation in the intervention would be immediately suspended. If this dissent was maintained over a period of time, the participant would be withdrawn from the study.

### 3.4.3 Beneficence

Whilst all the guidelines considered in table 3.1 make some provision for beneficence, there is some disagreement in the literature about what beneficence is defined as. Whilst both Potocnik (2013) and Slaughter et al. (2007) defines beneficence as the need for actions to maximise benefits, Buchanan (2004) incorporates the provision to avoid harm in their definition. As previously discussed, it has been decided that whilst beneficence and non-maleficence are inherently interlinked, they should be considered as separate entities, in accordance with the views of Beauchamp and Childress (1989).

An important aspect of research is that there should be some element of benefit to conducting the study, whether direct or indirect. Direct benefit is described as gaining a therapeutic benefit to participation, including access to new pharmacological treatments, different methods for managing the neuropsychiatric symptoms of dementia and in some cases or in rare cases, a slowing of the progression of the condition (Slaughter et al., 2007; Bravo et al., 2003). Indirect benefits are those which arise as a result of participation in research, such as increased social interaction, the opportunity to “feel useful” and the feeling that they are contributing to the furthering of knowledge relating to their condition (Slaughter et al., 2007).

Participants should be made explicitly aware of the potential benefits of taking part in research. However, it is not always the case that research will lead to any direct benefit for the participants. Studies which do not have the potential to provide a direct therapeutic benefit to participants will be given a favourable opinion if “the research has the aim of contributing, through significant improvement in the scientific understanding of the individual's condition, disease or disorder, to the ultimate attainment of results capable of conferring benefit to the person concerned or to other persons in the same category or afflicted with the same disease or disorder or having the same condition” (Monroe et al., 2013). In such situations, participants should be informed of this lack of direct benefit (Monroe et al., 2013; Slaughter et al., 2007). Monroe et al. (2013) argue that this lack of direct benefit should not lead to the automatic exclusion of PwDs in research participation. Whilst the research may not lead to any therapeutic benefits, there may be some form of indirect benefit experienced by the PwD. However, in cases where people lack the capacity to consent to research it is important that this lack of direct benefit is given careful consideration.

In the case of this research, it was hoped that facilitating positive reminiscence using technology would have emotional benefits for participants. For the participants who were provided with the tablet com-

puter, the benefit of participation was anticipated to be direct. The control group was not anticipated to gain any direct benefit from participation in the research. However, it is hoped that they would receive some indirect benefit from participating in the research. One dyad who were included within this control group was keen to participate in the research, however, the care-giver was extremely apprehensive with utilising technology. This couple was included in the control group in order to allow them to participate without the requirement for them to manage technology. Subsequently to the completion of the intervention period, both couples in the control group were shown the developed application and were provided with the opportunity to obtain a copy of the application, with the same level of support to adopt the technology as given to the intervention group. In addition, the dyads who participated in the development of the application were also anticipated to receive indirect benefits of being part of the research process. The attendance of focus groups designed to aid the development process provided an additional opportunity for them to socialise with other couples experiencing the same challenges. In addition, they were able to drive the interface development, which should aid them when trying to interact with the application.

#### 3.4.4 Non-maleficence

The principle of non-maleficence aims to minimise the risks participants are exposed to (Potocnik, 2013; Slaughter et al., 2007). Lange et al. (2013) assert that it is the duty of the researcher to ensure there is no risk to the participants health or their ability to work and socialise. In addition, researchers are obliged to ensure that the dependents of research subjects are not adversely affected by any interventions (Lange et al., 2013). In order to achieve this, researchers must pay careful attention to the potential for harm which could be inflicted by their study, and implement measures to minimise or eliminate these risks so as to limit intrusion into the lives of their participants (Murray, 2013; Lange et al., 2013; Buchanan, 2004). This is particularly important for people who lack the capacity to consent to research, leading to RECs requiring clarity on the potential risks and the measures implemented to alleviate them (Murray, 2013). It is important that participants are fully aware of the potential risks of the study and understand the implications of their involvement (Monroe et al., 2013).

In general, there are two main types of risk which must be considered when reviewing research protocols: minimal risk and net risk. Minimal risk is defined as the probability and magnitude of experiencing the risk being no greater than could be expected to be encountered in everyday life (Monroe et al., 2013; Slaughter et al., 2007; Fisk et al., 2007). According to Slaughter et al. (2007) minimal risk is dependent on both the participant and the context. Net risk is defined using a cost-benefit ratio, whereby, the magnitude of the benefit outweighs the potential risks (Monroe et al., 2013). The level of protection required to mitigate these risks is proportionate to the level of risk that is anticipated to be experienced by the participant, with minimal risk requiring the least protection (Fisk et al., 2007). However, despite a lower risk threshold for people who lack the capacity to consent (Slaughter et al., 2007), there is some

debate relating to what constitutes an acceptable level of risk for this group of participants (Fisk et al., 2007). As a precaution, it is often the case that RECs and researchers alike adopt a protectionist stance (Fisk et al., 2007), in some cases, it is recommended that surrogate consent is obtained for any research which is considered to have greater than minimal risks associated (Monroe et al., 2013).

It is the obligation of the researcher to ensure that the likelihood and effect of the potential risk is minimised. This may involve the integration of multiple safeguards to ensure all parties are adequately protected (Monroe et al., 2013). However, in cases where these protections are ineffective, resulting in lasting effects for the participants, it is the legal obligation for researcher pay for any injuries experienced (Monroe et al., 2013).

The potential for risk is always present in research. There was the potential for distress during the first study, the beta testing stage of the third study and throughout the extended testing period. The reliving of memories has the potential to cause emotional distress to the participants, if they are prompted to remember an event or a person which makes them experience negative emotions. In a effort to minimise the risk of this occurring during the testing interventions participants are encouraged to only enter positive memories into the tablet's memory catalogue. In addition, the information sheets included in the questionnaire and the extended testing period included contact details for both Mind and the Samaritans.

### 3.4.5 Justice

Justice is a multi-faceted concept, with two main elements. Firstly, as the BPS define it, there is a responsibility to ensure that the knowledge generated is beneficial to the participants and the "common good" (BPS, 2014). This is a concept which is confirmed by Potocnik, who states that fairness and entitlement should include "not only the patient and immediate family, but society at large" (Potocnik, 2013). Beauchamp and Childress (1989), however, consider the importance of treating people equally only in the cases where they can be considered equal. Beauchamp and Childress state that no person should be treated unequally unless there is a difference between them which is relevant to the treatment at stake. For example, when investigating the effectiveness of a new treatment for Alzheimer's medication, two people living with the condition should be treated equally. However, a person who is not living with the condition cannot expect to be treated with the same medication as those with a diagnosis, as for the purposes of the trial, they would be considered unequal. Secondly, researchers have a duty to ensure that the burden of research is spread fairly amongst the demographic being investigated, and not rely on a small sample of the population too heavily, thus avoiding exploitation of this group (Lange et al., 2013).

In this research project, all people who are participating in the research will be given the opportunity to obtain a copy of the developed application, regardless of which study was completed. One group of

participants were involved in the control group intervention, and therefore, did not use the application during the study. However, subsequent to the completion of the study, the control group participants were visited and provided with a demonstration of the application together with any support they require, should they decide to adopt the technology. It is hoped that the research project will have a positive effect on society at large, with a particular application to people living with dementia. The project aimed to investigate the adoption of a technology-supported positive reminiscence intervention. The findings relating to usability and adoption of technology in this user group has the potential to inform the development of further technology based support mechanisms to help people live well with dementia. In addition, it is hoped that the developed application itself will have a positive impact on people living with dementia and their care-givers.

### 3.4.6 Scientific Value

Only the Nuremberg Code and the BPS principles consider the scientific value of the research project as its own principle, defining it as the need to ensure scientific and scholarly standards are upheld (BPS, 2014). However, it could be argued that scientific value is extremely important. If the research is not considered to be scientifically robust, the aims of the project may not be achieved, and therefore, any potential harm or inconvenience experienced by the participants would be pointless. In the case of projects which are high in risk, this is particularly important.

## 3.5 Conclusion

Dementia is characterised as a very unique condition, whereby every person living with a diagnosis will experience the progression differently. However, despite this, there are particular symptoms which are typically experienced during each stage of the progression. Therefore, as suggested by Monroe et al. (2013), it is important that the participants recruited represent a representative cross-section of people, in various stages of the condition. This is particularly important within the HCI domain, to ensure all target users are able to interact effectively with the developed system. However, this needs to be balanced with participants being able to actively engage with the participatory development process. Taking this balance into account, it has been decided that for this project, only participants in the earlier stages of dementia will be included. This will allow them to actively participate in the design process of the application. From a HCI perspective, people in the later stages of dementia should be included in future research to assess the accessibility, usability, user experience and user acceptance elements of the application. However, this is outside the scope of this project.

Due to the nature of this research project, it was decided that the best approach to obtaining an ethical opinion, was to submit each individual study separately. Studies 1, 2 and 4 were reviewed by

the School of Computing REC. However, study 3 was reviewed by the NHS National Research Ethics Service (NRES) REC South Central Berkshire. It was previously believed that due to the inclusion of people living with dementia, a review under the MCA was required. However, during the course of the review, it was decided that the research could take place involving people in the earlier stages of dementia, where capacity would not be an issue. As the ethical opinion of the third study was obtained first, an increased knowledge of whether a review under the MCA was required allowed the subsequent studies to be submitted to the appropriate review body.

## CHAPTER

# 4

# REMINISCENCE THERAPY

## 4.1 Introduction

The concept of reminiscence was first introduced by Butler in 1963 in his paper discussing the importance of life review in the elderly. Initially, it was based on work carried out in mental institutions, however, Butler remarked that reminiscence appeared to be a natural element of successful ageing, which should not be confined to mental institutions (Butler, 1963). Since then, reminiscence interventions have evolved dramatically and are now widely used within many fields, as well as with the elderly.

### 4.1.1 Defining Reminiscence

Whilst there is no consistent definition of reminiscence, there is a consensus relating to the components of the process (Dempsey et al., 2014). It can generally be described as the recall of personal memories (Westerhof et al., 2010, 04; Hallford & Mellor, 2013; Haslam et al., 2010; Cappeliez & O'Rourke, 2006; Cappeliez, Rivard, & Guindon, 2007). Authors have attempted to develop a more comprehensive definition (Westerhof et al., 2010, 04). The definition which is regularly cited was developed by Bluck and Levine (1998), who define the term as:

*the volitional or non-volitional act or process of recollecting memories of one's self in the past. It may involve the recall of particular or generic episodes that may or may not have been previously forgotten, and that are accompanied by the sense that the remembered*

*episodes are veridical accounts of the original experiences. This recollection from autobiographical memory may be private or shared with others (pp. 188)*

The more comprehensive definition for reminiscence mentions that it can be “volitional or non-volitional” (Bluck & Levine, 1998). This recognises that reminiscence can be spontaneous (Cappeliez, Guindon, & Robitaille, 2008) or memories can be evoked for a specific reason or purpose (Cappeliez et al., 2008; Dempsey et al., 2014; Grasel, Wiltfang, & Kornhuber, 2003). The aim of this research project is to tap into the volitional aspect of reminiscence. In addition, the nature of reminiscence is such that memories which were previously considered forgotten, can be recalled with the correct prompt (Westerhof et al., 2010, 04). This is particularly important for PwDs as there is often an emphasis on the lost faculties rather than those which remain.

#### 4.1.2 Implementation of Reminiscence

Initially, it was believed that reminiscence was a product of disengagement theory. Reminiscence was also associated with senility, a decline in cognition, and was seen as a cause of dementia (Coleman, 2005; Hallford & Mellor, 2013). Therefore, older people were actively discouraged from reminiscing (Chueh & Chang, 2014). However, since Butler’s seminal 1963 paper discussing the importance of reminiscence and life review, the belief that this intervention has the potential to lead to successful ageing has gained support (Hallford & Mellor, 2013; Dempsey et al., 2014; P. T. Wong & Watt, 1991). As a result, there has been a re-evaluation of reminiscence as a natural part of the ageing process, which can trigger a life review process (Hallford & Mellor, 2013). This has led to increased interest in the functions of reminiscence, together with investigations into the benefits of participating in the intervention.

In the early days of reminiscence, it was assumed that the process was specific to older adults, particularly those who are in residential care (Coleman, 2005; MacKinlay & Trevitt, 2010), however, this is not the case (Westerhof et al., 2010, 04; Hallford & Mellor, 2013; Cappeliez et al., 2007; Dempsey et al., 2014). There is research which suggests that younger adults reminisce just as much as those who are older (Westerhof et al., 2010, 04; Westerhof & Bohlmeijer, 2014). Reminiscence can be seen as an important cognitive development activity throughout the lifespan, with people utilising it for different purposes at various stages in their life (Westerhof et al., 2010, 04; Hallford & Mellor, 2013; Westerhof & Bohlmeijer, 2014; Coleman, 2005; Cappeliez & O’Rourke, 2006; Cappeliez et al., 2007; Webster, 2003). In addition, it is thought that reminiscence serves as a method for developing a narrative identity over the life course from adolescence onwards (Westerhof & Bohlmeijer, 2014). Therefore, whilst the developed program will be designed for use by older adults, there is the potential for it to be applicable to people of all ages.

Traditionally, reminiscence utilises familiar prompts, such as photographs, music, newspapers, and



household items to evoke memories (Brooker & Duce, 2000; Dempsey et al., 2014; Grasel et al., 2003; Politis et al., 2004; Tadaka & Kanagawa, 2007; J.-J. Wang, 2007; Testad et al., 2014, 07; Gonzalez et al., 2015; J.-J. Wang, 2005; Woods et al., 2005; J. C. C. Chung, 2009; Cotelli, Manenti, & Zanetti, 2012; Azcurra, 2012). The aim of these prompts is to stimulate all five senses (Brooker & Duce, 2000), with the intention that these would become “catalysts to stimulate the process of reminiscence” (Dempsey et al., 2014). There is some discussion with regard to the best type of prompt to utilise, however, there is agreement that both music and photographs are effective (Ashida, 2000; Dempsey et al., 2014; Mulvenna et al., 2011). Music is particularly effective for people living with dementia as their ability to respond to the stimulus remains despite the decline of other cognitive abilities (Ashida, 2000). Furthermore, the use of images has the potential to lead to a greater number of responses than textual prompts. However, the use of text based methods to evoke memories resulted in more thoughtful responses (Mulvenna et al., 2011). It is important to ensure that these memory prompts are designed to be appropriate to the intended audience, taking their age, interests, and cultural background into account (Dempsey et al., 2014; Tolson & Schofield, 2012; Okumura, Tanimukai, & Asada, 2008). It is also suggested that personalised memory prompts aid the reminiscence process (Dempsey et al., 2014; Cohen-Mansfield, Thein, Dakheel-Ali, & Marx, 2010). This need to take the target users into account will be considered in chapter 5, when the optimal types of memory will be investigated. Through exploring the types of memory which are appropriate for use with people over the age of 50, the developed reminiscence program will be tailored to ensure the prompts are relevant and effective at evoking positive memories.

Withdrawal or exclusion from social groups is often an issue following a diagnosis of dementia (Tadaka & Kanagawa, 2004; J. C. C. Chung, 2009; Brooker & Duce, 2000). Whilst reminiscence therapy (RT) can be performed individually, it is often conducted in a group setting (Baillon et al., 2005; Haslam et al., 2010). The provision of RT groups for PwDs provide an opportunity to engage in meaningful social interaction, through the sharing of memories (Dempsey et al., 2014; Tadaka & Kanagawa, 2007). The sharing of memories within the group promotes the development of a “deeper” bond between the participants (Sharif, Mansouri, Jahanbin, & Zare, 2010). Whilst there are many instances where it is stated that group reminiscence activities can be beneficial to PwDs, there is very little research which specifically demonstrates this effect. Research conducted by Haslam et al. (2010) found that participants who took part in group activities had a greater improvement in their health and well-being when compared to those who received individual interventions. However, the results of the study do suggest that participating in individual reminiscence is beneficial, just to a lesser extent than the group based activities. Furthermore, generalisation is difficult as all the participants were living in permanent residential care. In addition, using a case study approach, Tanaka et al. (2007) observed that a PwD who participated in individual reminiscence did experience an improvement in their attention, volition and a reduction in depression. Group RT may be beneficial to those who are residing in permanent

care, however, travelling to groups can represent an increased burden for the care-givers of PwDs in the community. Therefore, the group intervention may not be appropriate for this group of users. This is an area which lacks investigation and should be considered in the near future. In order to alleviate the burdens associated with organising transport to group sessions, the reminiscence intervention developed in this project will be designed to be carried out at home, and individually with the care-givers or family members.

### 4.1.3 Applications in Dementia Care

RT is cited by Woods et al. (2005) as “one of the most popular psychosocial interventions in dementia care” which is “highly rated” by both staff and participants. The intervention naturally lends itself to use with PwDs, and hence, is a commonly used intervention for both older people and those who are living with dementia (Gonzalez et al., 2015). The onset of dementia is often associated with a decline in short-term memory function (Mahmud et al., 2010; Langdon & Thimbleby, 2010). However, reminiscence utilises the remote memories which have been well-rehearsed over the life span and often remain intact for a longer period of time after symptoms appear. It is often the case with dementia that a diagnosis makes the PwD focus on the capacity they are losing. The use of reminiscence provides PwDs the opportunity to draw their attention to the skills which remain, and harness them. This allows the PwD to confidently contribute to conversations when discussing their memories, potentially minimising the psychological burden felt by their deteriorating condition and encouraging them to enjoy every moment. In addition, RT provides PwDs with an activity which is easy to engage in and is age-appropriate.

It is important to ensure that PwDs are considered when designing reminiscence interventions. Gonzalez et al. (2015, citing Martinez, 2012) suggest there are four main factors need to be considered when developing an intervention based on RT: cognitive abilities of participants, group composition, group size and materials used. With regards to cognitive abilities, it is recommended that the objectives of the intervention are flexible to consider the changing abilities of the participants. This is an important aspect regardless of the group intervention taking place. PwDs will inevitably experience a decline in their condition. Through ensuring they are provided with interventions which are appropriate to their capabilities, PwDs can actively engage in a social environment for longer than would be possible without the adaptive interventions. The varying cognitive abilities need to also be considered when reminiscence groups are formed, with people at similar stages of the dementia progression being placed together. Another factor which needs to be carefully considered is the size of the group in which RT is conducted. A group which is too big will not provide all the participants ample opportunity to contribute and may make it difficult for a shared sense of community to develop. Furthermore, a group which is too small may not foster sufficient memory generation and may become awkward for the participants. Finally, it is important to consider the materials which are used to evoke memories. Memory prompts which

are personalised to the participants leads to greater engagement with the artefact (Cohen-Mansfield, Thein, et al., 2010), suggesting that any materials used should be as close as possible to the participants (Gonzalez et al., 2015). Ensuring the chosen materials are appropriate for the PwD can be achieved in two ways: the inclusion of the person or using the knowledge of family members and friends. During the course of this project, two of these four factors were considered, cognitive abilities and the materials used. The two factors relating to the composition of the group will not be relevant for this project, as the developed intervention is designed to be conducted individually within the home environment. The cognitive abilities will be considered when designing the interface for the technology-based solution (see chapter 6). In addition, the materials to be utilised within the positive reminiscence program will be investigated during chapter 5.

#### 4.1.4 Chapter Structure

The aim of this chapter is to discuss the background relating to RT, with an emphasis on how it can support people living with dementia. It will first describe the various functions of reminiscence, with the aim of deciding the functions which should be encouraged by the positive reminiscence program. The four main types of reminiscence intervention will then be discussed. Finally, this chapter will assess the evidence relating to the effectiveness of the intervention for older people and PwDs.

## 4.2 Functions of Reminiscence

Over the years, there have been many attempts to define the various functions which reminiscence serves. L. M. Watt and Wong (1991a) used content analysis of qualitative data obtained from 640 participants to derive six functions of reminiscence: integrative, instrumental, transmissive, narrative, escapist and obsessive. First, integrative reminiscence is described as the reconciliation of memories, with the aim of achieving “a sense of meaning” (L. M. Watt & Wong, 1991a). Second, the use of previous memories to aid the solving of problems currently being experienced is known as the instrumental function. Third, memories which are told with the intention of teaching or informing future generations is transmissive reminiscence. Fourth, narrative reminiscence aims to give people the opportunity to share their memories. Fifth, reminiscence which has an escapist function helps the person relieve boredom resulting from an under-stimulating environment. Finally, obsessive reminiscence leads to the person ruminating on memories, with the aim of justifying feelings of bitterness.

Using the Reminiscence Functions Scale (RFS), Webster (1993a) quantitatively identified eight functions of reminiscence: identity, problem solving, teach-inform, conversation, boredom reduction, bitterness revival, death preparation, and intimacy maintenance. In general, the first six correspond with the functions identified by L. M. Watt and Wong (1991a). Both death preparation and intimacy maintenance

were initially identified using the RFS. Whilst L. M. Watt and Wong (1991a) do identify the death preparation function, they considered it to be part of the integrative (identity) function. However, Webster (1993a) highlights the need to consider death preparation as a function in its own right. This aligns with the knowledge that reminiscence occurs throughout the life span (Cappeliez et al., 2007), with integrative reminiscence occurring throughout and death preparation engaged in when approaching the end of life. This discrepancy between the definitions could be attributed to the populations that the two authors used to derive their functions. Whilst Webster (1993a) included participants in the age range of 18-46, L. M. Watt and Wong (1991a) included people between the ages of 65 and 95. Therefore, people included in the L. M. Watt and Wong (1991a) study were approaching the conclusion of their life, making preparation part of integrative functioning when compared to the younger demographic of the Webster (1993a) study. Intimacy maintenance is defined as “a process whereby cognitive and emotional representations of important people in our lives are resurrected in lieu of the remembered person’s physical appearance” (Westerhof et al., 2010, 04).

It has generally been agreed that there are eight functions of reminiscence: identity (integrative), problem solving (instrumental), teach-inform (transmissive), conversation (narrative), boredom reduction (escapist), bitterness revival (obsessive), death preparation, and intimacy maintenance (Cappeliez et al., 2008), with results of the studies conducted by L. M. Watt and Wong (1991a) and Webster (1993a) having been replicated (Hallford & Mellor, 2013). There are, however, some limitations to simplifying the functions of reminiscence into these eight distinct categories (Cappeliez & O’Rourke, 2006). Firstly, it must be recognised that functions of reminiscence are not exclusively experienced (Cappeliez & O’Rourke, 2006; Hallford & Mellor, 2013). Therefore, a memory can be used for multiple reasons. The example of this given by Cappeliez and O’Rourke (2006), is that a memory such as one of past success may help resolve an issue (problem solving function), may “transmit a life lesson” (teach-inform function) and may serve to improve self-esteem (identity function). Therefore, simply approaching memories in isolation, assuming they only serve one function is an “overly simplistic” viewpoint. Secondly, the use of self-report reminiscence may produce results which are biased towards functions which require the participants to be aware of the reminiscing they are engaged in. It has also been suggested that people have a tendency to remember instances of reminiscence which have a self-promotion or social function, with less awareness of memories which are used for guidance purposes.

The grouping of reminiscence functions based on their uses and effect on the person reminiscing remains underresearched (Coleman, 2005; Cappeliez & O’Rourke, 2006). There have been various attempts in the past, with table 4.1 demonstrating the results obtained by various studies.

Table 4.1: Table demonstrating the attempts to categorise the various functions of reminiscence

	Identity	Problem Solving	Bitterness Revival	Boredom Reduction	Teach-Inform	Conversation	Death Preparation	Intimacy Maintenance
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<b>Positive</b>	A; B; C; D	A; C; D					B; C; D	
<b>Negative</b>			A; B; C; D	A; B; C; D				C; D
<b>Social</b>					A; C; D	A; C; D		
<b>Guidance</b>		B			B			
<b>Emotion</b>						B		B
[A] L. M. Watt and Wong (1991b), P. T. Wong and Watt (1991) - did not identify death preparation and intimacy maintenance in their analysis [B] Cappeliez et al. (2005, 2007) [C] Cappeliez and O'Rourke (2006), Cappeliez et al. (2008) [D] Westerhof et al. (2010, 04), Webster (1993b)								

Research by Cappeliez et al. (2005, 2007) suggested that there were four groups of reminiscence functions. However, they later revised their model (Cappeliez & O'Rourke, 2006; Cappeliez et al., 2008), which aligned their finding with others in the field, to produce three functions of reminiscence (positive, negative and social). From table 4.1, it can clearly be seen that identity, problem solving and death preparation are considered to be positive functions of reminiscence. Bitterness revival, boredom reduction and intimacy maintenance are defined as negative functions. Finally, teach-inform and conversation are seen as social functions of reminiscence.

The following subsections will discuss these functions in further detail, together with evidence of their impact on the reminiscer.

### 4.2.1 Positive Functions

For the purposes of this project and based on table 4.1, it will be defined that the identity (integrative), problem-solving (instrumental) and death preparation functions will be considered to serve a positive purpose.

#### 4.2.1.1 Identity

The identity function of reminiscence utilises memories of the past to develop a clear and crystallised sense of who we are (Westerhof et al., 2010, 04; Westerhof & Bohlmeijer, 2014; Webster, 2003). It allows people to obtain and maintain a sense of coherence, worth and meaning in life (Cappeliez et al., 2008; Cappeliez & O'Rourke, 2006; Cappeliez et al., 2007; Webster, 2003; P. T. Wong & Watt, 1991). Through the use of integrative functions, the reminiscer is encouraged to reconcile and accept the past (Cappeliez et al., 2008; P. T. Wong & Watt, 1991), evoking a process of adjustment (Woods et al., 2005).

Research by Cappeliez and O'Rourke (2006) suggests that higher levels of reminiscence for the identity function is related to successful ageing. However, P. T. Wong and Watt (1991) imply that the achieve-

ment of integrity, as a result of this function, leads to successful ageing, not the reminiscence process itself. In addition, Cappeliez and O'Rourke (2002) found that an increased frequency of identity related reminiscence was linked to a increased amount of neuroticism and higher emotional stability. However, care needs to be taken when interpreting this result, as the sample size of the study conducted by Cappeliez and O'Rourke (2002) was only 89, making generalisation to the population difficult. Hence, it is difficult to confirm whether reminiscence focusing on the identity function can contribute to successful ageing.

Studies by L. Watt and Cappeliez (2000) and Cappeliez and O'Rourke (2002) found the identity function of reminiscence was able to alleviate symptoms of depression, when delivered using a "structured clinical intervention" (Cappeliez et al., 2007). However, both these studies used small sample sizes (26 and 89 participants respectively), therefore, suggesting that further research was required with larger samples to establish conclusive results. This problem was overcome by Cappeliez and O'Rourke (2006) who found a negative association between reminiscence for identity purposes and depression, using a sample size of 412, validating the results of the two previous studies. Thus, the promotion of integrating positive and negative memories is able to reduce depressive symptoms in older adults.

A key aspect of reminiscence for identity functions is the re-evaluation and transformation of negative life events into good outcomes, which could additionally lead to obtaining closure on past conflicts (Cappeliez et al., 2007; Cappeliez & O'Rourke, 2006; P. T. Wong & Watt, 1991). In cases where the reminiscer achieves integrity, increased life satisfaction, higher levels of self-esteem, better mental health and a sense of life coherence is achieved (Cappeliez & O'Rourke, 2006; P. T. Wong & Watt, 1991). Research by Cappeliez and O'Rourke (2006) also suggests that engaging in reminiscence for identity purposes is important for personal development and well-being. Whilst the sample size was reasonably large ( $N = 412$ ), the subjects who participated in this study were between the ages of 50 and 84, making generalisation to the younger population impossible. However, as the target user group is the over 50s, this will not particularly be a problem for this research project. It is also important to recognise that negative memories may be associated with feelings of guilt, failure and depression which may not be resolved if the integrative reminiscence is not successful (P. T. Wong & Watt, 1991). Therefore, as suggested that a key aspect of engaging in guided reminiscence for identity purposes is the use of a trained professional, who is able to support the reminiscer through the process. This makes reminiscence for integrative purposes potentially inappropriate as an unsupported at-home intervention.

#### 4.2.1.2 Problem Solving

The use of past memories in order to provide strategies for managing current problems is reminiscence for problem solving (Cappeliez et al., 2008; P. T. Wong & Watt, 1991; Dempsey et al., 2014; Cappeliez & O'Rourke, 2006; Cappeliez et al., 2007; Webster, 2003; Cappeliez et al., 2005). It is often used

at times in life which are stressful to the reminiscer, allowing them to utilise past coping mechanisms (Westerhof et al., 2010, 04; Westerhof & Bohlmeijer, 2014; Webster, 2003) and recall instances of successful adaptation (Cappeliez et al., 2007). Additionally, reminiscence for problem solving purposes revives strategies used to successfully cope during difficult and stressful life events allowing them to be implemented in the present (Gonzalez et al., 2015; Westerhof et al., 2010, 04; Cappeliez et al., 2008, 2007; Cappeliez & O'Rourke, 2006).

It is suggested by Cappeliez and O'Rourke (2006) that the use of instrumental reminiscence allows the person to present themselves as capable and competent. Research by both P. T. Wong and Watt (1991) and Cappeliez et al. (2007) support this finding that reminiscence helps a person view themselves as capable, competent and self-efficacious. This is then said to contribute to an increase in self-esteem, morale and motivation, encouraging an active problem solving stance, rather than perceiving themselves as "a passive victim of fate" (Cappeliez et al., 2007).

Reminiscence for problem solving is seen to act as a buffer to emotional distress (P. T. Wong & Watt, 1991), which could in turn predict lower levels of anxiety (Hallford & Mellor, 2013). Whilst the study conducted by P. T. Wong and Watt (1991) does utilise a large sample size ( $N = 171$ ), the study is yet to be validated for reminiscence. In addition, Korte, Bohlmeijer, Westerhof, and Pot (2011) found reduced levels of anxiety for participants who engaged in life review therapy. Whilst life review is a form of reminiscence therapy, this study can not be considered to conclusively validate the findings of P. T. Wong and Watt (1991) as the factors being measured are different.

Reminiscence for problem solving "reflects a sense of internal control", with this contributing to an increase in life satisfaction (P. T. Wong & Watt, 1991). However, a study investigating how the functions of reminiscence influences life satisfaction conducted by Cappeliez et al. (2005) found no evidence of this effect. Both studies have a reasonably large sample size ( $N = 400$  and  $N = 420$ , respectively). However, the study conducted by P. T. Wong and Watt (1991) utilises a qualitative content analysis of interviews, whereas Cappeliez et al. (2005) use the RFS to quantitatively analyse reminiscence functions. Whilst the quantitative analysis would be preferable due to its replicable nature, neither study has been validated. This makes drawing conclusions with regards to the impact on life satisfaction as a result of internal control difficult.

#### 4.2.1.3 Death Preparation

The death preparation function of reminiscence is utilised to help a person come to terms with approaching the end of their life (Cappeliez et al., 2008; Cappeliez & O'Rourke, 2006). It allows the reminiscer to use past memories with the aim of arriving at a calm and accepting attitude towards their mortality (Westerhof et al., 2010, 04; Hallford & Mellor, 2013; Westerhof & Bohlmeijer, 2014; Cappeliez & O'Rourke, 2006; Cappeliez et al., 2007; Webster, 2003). Cappeliez et al. (2007) suggest

this type of reminiscence demonstrates a spiritual self who is able to approach death and beyond with serenity. Cappeliez and O'Rourke (2006) suggest that this type of reminiscence allows people to approach the end of their own life with a feeling of completeness and wholeness. In addition, the use of this reminiscence function provides the reminiscer with a sense of closure on their life (Webster, 2003).

Due to their advanced age and relative proximity to death, it is often older people who engage more frequently in reminiscence for the purposes of death preparation (Webster, 1993b), allowing them to reduce any feelings of anxiety and fear as they approach their end of life (Cappeliez & O'Rourke, 2006). However, Webster (2003) suggest the opposite, with death preparation contributing to higher levels of anxiety and fear due to the "rupturing of longtime personal bonds" and prominence given to the memories of family, friends and lovers who will be missed the most. From this conflict, we can conclude that there is insufficient knowledge relating to the effect of reminiscence for death preparation in older adults.

There is research which suggests that reminiscence for the purposes of death preparation can have a negative effect on the psychological functioning of older people (Cappeliez & O'Rourke, 2006; Cappeliez et al., 2005). With both these studies containing large samples of participants it can be considered that this conclusion is valid. However, despite this, authors consistently place death preparation as a positive function rather than a negative one (Cappeliez et al., 2005), suggesting that the benefits gained through increased life satisfaction, improved mental health, and a sense of closure on life outweigh the negative psychological functioning experienced.

It has been demonstrated that the frequency of reminiscence for the purposes of death preparation can be used to predict levels of life satisfaction (Coleman, 2005; Cappeliez et al., 2005; Cappeliez & O'Rourke, 2006), which can lead to a more constructive approach to mortality and an improvement in well-being (Cappeliez et al., 2007, 2005). The finding that death preparation can predict life satisfaction was quantitatively found in large scale study conducted by Cappeliez et al. (2005) and later validated by another project with a substantial sample size (Cappeliez & O'Rourke, 2006). This implies that reminiscence for the purposes of death preparation can have a positive impact on the life satisfaction felt by the reminiscer.

#### 4.2.2 Negative Functions

Table 4.1 suggests the functions of bitterness revival, boredom reduction and intimacy maintenance should be considered to have negative effects on the reminiscer.



#### 4.2.2.1 Bitterness Revival

Bitterness revival involves the regular reiteration of negative memories from difficult life situations, and a pre-occupation with past conflicts (Westerhof et al., 2010, 04; Cappeliez et al., 2008; Cappeliez & O'Rourke, 2006; Cappeliez et al., 2005). It is also known as obsessive reminiscence and often involves feelings of guilt, bitterness and despair (Westerhof et al., 2010, 04; P. T. Wong & Watt, 1991), with the memories providing justification for any negative thoughts or emotions experienced by the reminiscer towards other people (Westerhof et al., 2010, 04; Westerhof & Bohlmeijer, 2014; Webster, 2003). It is suggested by Cappeliez et al. (2007) that the bitterness revival function is the opposite of reminiscence for the purposes of identity, demonstrating a failure to integrate previous life experiences which represent problematic events (P. T. Wong & Watt, 1991). In addition, this type of reminiscence demonstrates a self which is "fragmented and lacking meaning" (Cappeliez et al., 2007). Cappeliez et al. (2005) associate this type of reminiscence with emotional vulnerability, weaker goal setting, and psychological distress.

The bitterness function often results in the person becoming increasingly depressed and can also maintain levels of depression (Cappeliez et al., 2007). People who are living with depression will often focus on negative information, whilst ignoring the positive memories in order to support their "dysfunctional review" of their life (Gonzalez et al., 2015). Engaging in reminiscence for bitterness revival can lead to a spiralling effect, whereby, the depressed person will continue to ruminate on negative emotions, which will have a detrimental effect on their health and well-being (Cappeliez et al., 2008).

Research conducted by P. T. Wong and Watt (1991) found that bitterness revival was effective at inducing feelings of depression, agitation, panic and in some extreme cases, suicide. It has also been found that this reminiscence function is associated with negative emotions (Cappeliez et al., 2008; P. T. Wong & Watt, 1991), with Cappeliez et al. (2008) finding that 90% of instances had a negative salience. Whilst this study had a small sample size ( $N = 88$ ), the results validate an earlier conclusion established by P. T. Wong and Watt (1991). This suggests that reminiscence for bitterness revival predominantly leads the person to experience negative emotions, with the intensity of these feelings those who are already affected increasing.

A study conducted by P. T. Wong and Watt (1991) found a link between the frequency of obsessive reminiscence and the success of one's ageing process, with successful older adults utilising the bitterness revival function less than those who are unsuccessful. This association was validated quantitatively by Cappeliez et al. (2005) confirming that the elderly who are successful are those who utilise this function less frequently. Thus, it is suggested by Cappeliez et al. (2007) that individuals who regularly engage in this form of reminiscence would benefit from participating in an intervention which aims to change their negative pattern of reminiscence to avoid this function and, hence, make their ageing process more successful. Therefore, the present research will aim to avoid evoking memories which revive feelings of

bitterness, in order to avoid this function of reminiscence.

#### 4.2.2.2 Boredom Reduction

Reminiscence for the purposes of reducing feelings of boredom often involves using memories to express nostalgia for the past, and a desire to return to the “good old days” (Westerhof et al., 2010, 04; Cappeliez et al., 2007, 2005; P. T. Wong & Watt, 1991). Sometimes, this type of reminiscence is used as a way to escape an environment which is considered under-stimulating (Westerhof et al., 2010, 04; Westerhof & Bohlmeijer, 2014; Cappeliez et al., 2007), and as such, memories are used to fill a void in interest or engagement (Cappeliez et al., 2008; Westerhof & Bohlmeijer, 2014; Cappeliez & O’Rourke, 2006; Cappeliez et al., 2007; Webster, 2003). Boredom reduction can also be observed as a technique to avoid recognising a present which is considered to be unfulfilled (Cappeliez et al., 2005). This type of reminiscence is often seen as an easy method to distract elderly people from current problems (Dempsey et al., 2014). However, in contrast, it is shown to lead to a lack of purpose being experienced by the reminiscer (Cappeliez & O’Rourke, 2006; Cappeliez et al., 2005).

The boredom reduction function of reminiscence can involve three main elements, a magnified view of the past (Cappeliez et al., 2008; P. T. Wong & Watt, 1991), contrasting of the past with the present (Cappeliez et al., 2008; P. T. Wong & Watt, 1991), and a desire to return to an idealised past (Cappeliez et al., 2007, 2005; P. T. Wong & Watt, 1991; Cappeliez et al., 2008). Additionally, P. T. Wong and Watt (1991) suggest that older people may utilise escapism as a self-esteem protection strategy whereby they re-imagine themselves as the hero of a particular situation when confronted with the natural decline associated with older age.

Whilst the use of reminiscence for boredom reduction can provide a sense of instant relief, it may become maladaptive in the long term (P. T. Wong & Watt, 1991). There is research which suggests that the long term use of reminiscence of the purposes of boredom reduction leads to an increase in negative feelings, particularly those related to apathy (Cappeliez et al., 2008, 2005; Cappeliez & O’Rourke, 2006). With the exception of the study conducted by Cappeliez et al. (2008), the sample size of the studies are 400 participants and above. These large quantitative studies imply that the boredom reduction function of reminiscence has a negative effect on a person. The qualitative study conducted by Cappeliez et al. (2008) serves to validate this finding. Therefore, it may be the case that reminiscence for boredom reduction can be used to in the short term, however, it is important to ensure that this function is not used on a long term basis, as it will result in higher levels of negative affect. Hence, this research will aim to prevent PwDs from engaging in reminiscence for boredom reduction purposes.

#### 4.2.2.3 Intimacy Maintenance

Reminiscence for intimacy maintenance involves resurrecting cognitive and emotional memories of significant others who are no longer in one's life physically (Westerhof et al., 2010, 04; Westerhof & Bohlmeijer, 2014; Webster, 2003), predominantly due to death (Hallford & Mellor, 2013). It is used as a way of keeping memories alive to maintain a closeness with someone who is separated from the reminiscer (Cappeliez et al., 2008; Cappeliez & O'Rourke, 2006; Cappeliez et al., 2007, 2005). In addition, it can ensure memories of the departed person remain accessible (Cappeliez et al., 2005) allowing the reminiscer to present an image of themselves as faithful to the departed person (Cappeliez et al., 2007). Cappeliez and O'Rourke (2006) also comment that this function of reminiscence can kickstart a process of self evaluation and a reconsideration of "one's life trajectory".

It is suggested that this function of reminiscence is indicative of a problematic or incomplete grieving process, which has led to unresolved feelings of grief (Cappeliez et al., 2008; Cappeliez & O'Rourke, 2006; Cappeliez et al., 2007). In a study conducted with 88 participants, Cappeliez et al. (2008) found that this incomplete grief process is associated with negative psychological outcomes. Additionally, it is suggested that engaging in this function of reminiscence can reactivate the loss experienced (Cappeliez et al., 2005, 2007). However, in a summary paper, Cappeliez et al. (2007) suggest that despite the negative emotions associated with this type of reminiscence, it could aid the reminiscer in accepting their loss, encouraging them to come to terms with not having the person physically in their life anymore. This is an area which needs to be further investigated to evaluate whether this function, in moderation, can lead to feelings of closure for a person.

Research has demonstrated that the intimacy maintenance function of reminiscence can contribute to negative affect and psychiatric distress (Cappeliez et al., 2008; Cappeliez & O'Rourke, 2006; Cappeliez et al., 2005), with a higher frequency of this type being associated with increased levels of depression (Cappeliez et al., 2007). It was demonstrated by Cappeliez et al. (2005) that dwelling on the passing of a significant other can predict psychiatric distress in the reminiscer. This effect was also found by Cappeliez et al. (2008) in a smaller qualitative study, which validated the findings of the large studies carried out by Cappeliez and O'Rourke (2006) and Cappeliez et al. (2005). It is suggested by Cappeliez et al. (2007) that people who are regularly engaging in this type of reminiscence can benefit from a program of integrative reminiscence in order to break the repetitive cycle of dwelling on absent family and friends. Therefore, in order to reduce the likelihood of experiencing the negative emotions associated with intimacy maintenance, the present research will aim to avoid evoking memories which employ this function.

### 4.2.3 Social Functions

The final two functions of teach-inform and conversation are regularly considered to be social in nature.

#### 4.2.3.1 Teach-Inform

The teach-inform function of reminiscence involves the passing on of cultural heritage and personal memories through the telling of memories to younger generations (Westerhof et al., 2010, 04; P. T. Wong & Watt, 1991). It is reported by P. T. Wong and Watt (1991) that older generations feel the need to leave their mark on the world, which can be achieved by “ingraining in their audience important ideas and values” through the use of this type of reminiscence. As such, memories which are discussed often have an instructional story or lesson of life (Westerhof et al., 2010, 04; Westerhof & Bohlmeijer, 2014; Cappeliez et al., 2008; Cappeliez & O’Rourke, 2006; Cappeliez et al., 2007), which can be used to pass on important information about life (such as moral lessons) and oneself (Webster, 2003; P. T. Wong & Watt, 1991). It has been described by Webster (2003) as an instructional alternative for narrative reminiscence (which will be further discussed in the next section).

As could probably be expected, reminiscence for teach-inform purposes is used more frequently by older generations than younger people (Webster, 1993b). This is due to the greater wealth of knowledge and experience held by older people when compared to the young. It is anticipated that the transmission of these memories and the additional knowledge provides older people both meaning and purpose in the twilight of their life (P. T. Wong & Watt, 1991). The use of reminiscence provides older people the opportunity to share the wealth of knowledge they have gained over their life course and allows younger people to learn from the mistakes of their elders.

Reminiscence for the purposes of teach-inform is often associated with social functioning (Cappeliez & O’Rourke, 2006) which is linked to positive emotions within a social context (Cappeliez et al., 2007). It can additionally be used to allow the person to convey an image of themselves as “experienced, wise and possibly self-enhanced” (Cappeliez & O’Rourke, 2006; Cappeliez et al., 2007). This can lead to admiration, respect, and an elevated mood (Cappeliez & O’Rourke, 2006).

The teach-inform function of reminiscence is often associated with intergenerational interactions (Cappeliez et al., 2007). This provides opportunities for the bond between the old and the younger to be strengthened, something which has become weakened in recent times (J. C. C. Chung, 2009). Cappeliez et al. (2007) observe that this type of interaction is seen by older adults as “prototypical”, which can give younger adults something to build on in the future (Cappeliez et al., 2007). In addition, reminiscence for teach-inform purposes can provide a social vehicle for people of different generations to engage in an “ongoing exchange of resources and learning” (J. C. C. Chung, 2009).

It is suggested by P. T. Wong and Watt (1991) that reminiscence for the purposes of teach-inform can have a positive effect on social adaptation of older adults. They comment that this type of reminiscence is a valuable social function for oral histories, which can enhance self esteem. However, the same authors found that there was no difference in the use of transmissive reminiscence between the group judged to be successfully ageing, and those who were considered unsuccessful (P. T. Wong & Watt, 1991). This lack of difference was attributed to the methodology used to gather the data, despite the reasonably large sample size. Therefore, it could be suggested that a validated and replicable quantitative method would potentially overcome this issue, something which is yet to be investigated.

#### 4.2.3.2 Conversation

Reminiscence which serves the conversation function involves the recounting of memories which have no evaluative or instructive purposes (Westerhof et al., 2010, 04; Cappeliez et al., 2008; Cappeliez & O'Rourke, 2006; P. T. Wong & Watt, 1991). It has been described by P. T. Wong and Watt (1991) as "any reminiscence which doesn't fit other categories". This type of reminiscence tends to be descriptive in nature (Cappeliez et al., 2008; P. T. Wong & Watt, 1991). The main functions of this type of reminiscence are described by P. T. Wong and Watt (1991) as providing routine biographical information (such as date and place of birth) and the sharing of anecdotes which are considered to be interesting or relevant to the listener.

The conversation function of reminiscence is associated with socialisation (Cappeliez & O'Rourke, 2006). It provides people with the opportunity to re-connect with old acquaintances, and foster new friendships through the use of shared memories (Westerhof et al., 2010, 04; Cappeliez et al., 2008; Westerhof & Bohlmeijer, 2014), developing social bonding (Webster, 2003). It is suggested by Cappeliez et al. (2005) that reminiscence for conversation purposes acts as a method for increasing well-being through the maintenance of interaction within social environments. In addition, it can provide the reminiscer with the opportunity to portray themselves as a pleasant, communicative and entertaining person in a social environment (Cappeliez et al., 2007). This emphasises the importance of the social nature of this type of reminiscence.

Whilst the adaptive function of this reminiscence remains unclear (P. T. Wong & Watt, 1991), there are suggestions that it can have a positive effect on the emotions and mental health of the reminiscer (Cappeliez et al., 2008; Cappeliez & O'Rourke, 2006; Cappeliez et al., 2005), particularly in social situations (Cappeliez et al., 2007). The use of this function of reminiscence provides a basis and opportunities for people to share positive emotions in social situations (Cappeliez et al., 2005, 2008; Cappeliez & O'Rourke, 2006; Cappeliez et al., 2007). It is suggested by Cappeliez et al. (2007) that the main purpose of the conversation function of reminiscence is to "share an entertaining story which will evoke, maintain or eventually increase positive feelings", with 70% of all reminiscences for this

purpose being associated with the same level or amplified positive emotions (Cappeliez et al., 2007, citing Cappeliez and Guindon, 2004). Later research by Cappeliez et al. (2008) found similar results, with 80% of instances of conversation reminiscence (called narrative in this study) being linked to positive emotions. Whilst both point to the same result that reminiscence for conversation purposes has a positive emotional effect on older people, it is difficult to know conclusively as only the study by Cappeliez et al. (2008) demonstrates the sample composition. However, research conducted by Cappeliez and O'Rourke (2006) using a sample size of 412 older people between the ages of 50 and 84 found that narrative reminiscence is effective in improving the mood and positive emotions of the participants. Additionally, research by Cappeliez et al. (2005) on a sample of 400 adults found that positive mental health was evoked as a result of this reminiscence function. This suggests that reminiscence for conversation purposes can have a positive effect on the reminiscer.

In addition to providing the reminiscer with positive emotions, it is suggested that narrative reminiscence can lead to successful ageing (Cappeliez et al., 2005). However, an earlier study carried out by P. T. Wong and Watt (1991) found no significant difference between successful and unsuccessful older adults with regards to narrative reminiscence. Whilst both studies utilised large sample sizes, the difference in results could be the nature of the studies conducted together with a potentially differing definitions of successful ageing, which is not defined in the study conducted by Cappeliez et al. Therefore, before conclusions with regards to the relationship between positive ageing and the use of reminiscence for conversation purposes can be drawn, more quantitative research needs to be conducted, to ensure replicability and validity.

#### **4.2.4 Research Focus**

The aim of this research is to promote the functions which evoke positive emotions, together with those which encourage socialisation. In recognition that some memories may be associated with multiple functions (Cappeliez & O'Rourke, 2006; Hallford & Mellor, 2013), the focus of the research will also be to minimise the potential for the negative functions to be evoked.

The following section will discuss the various types of RT intervention, with a discussion of the functions they aim to evoke and their target audience.

### **4.3 Types of Reminiscence**

In the literature, three main types of reminiscence are frequently identified: simple reminiscence (SiR), life review (LR), and life review therapy (LRT). However, there is also an increasing awareness of a fourth type of reminiscence, spiritual reminiscence (SpR). SiR involves the narrative recall of personally relevant memories. The interventions which involve LR utilise a systematic approach to evaluating

memories in order gain balance in life. Finally, SpR involves the finding of meaning within memories of events experienced during the life course.

The terms reminiscence and LR are often used interchangeably in the literature. However, Westerhof et al. (2010, 04) are careful to make the distinction between reminiscence, as the recall of memories, and LR, which involves the re-assessment of the lifespan with the intention of finding peace with one's life. Woods et al. (2005) are also keen to acknowledge the difference between reminiscence and LR, describing the main difference as their origins and facilitation. In contrast to reminiscence, LR has roots in psychotherapy and requires the use of a "therapeutic listener". In addition, the definition which will be used throughout this thesis does not require the evaluation and integration of memories to constitute reminiscence which is present in any LR interventions.

### 4.3.1 Simple Reminiscence

The telling of autobiographical memories in an unstructured and sometimes spontaneous manner is referred to as SiR (Hallford & Mellor, 2013). This type of reminiscence is the modality which is most often used when engaging PwDs in reminiscence activities (Haight et al., 2003). It is suggested by Westerhof et al. (2010, 04) that SiR is most appropriate for older adults who are in good mental health and those who find the sharing of personal memories a meaningful activity.

SiR is often conducted by participants in groups (Hallford & Mellor, 2013) or within a residential care home environment (Westerhof et al., 2010, 04). Whilst this group facilitation within residential care can be used to foster bonding (Westerhof et al., 2010, 04; Westerhof & Bohlmeijer, 2014), it is important to ensure that reminiscence is not used as an easy method to engage and distract participants from any concerns they may have in the present (Coleman, 2005). Utilising SiR for this purpose would invoke the negative function boredom reduction rather than the social functions that would encourage bonding between residents.

The main goal of SiR is to induce positive emotions and reduce any negative feelings experienced by the reminiscer (Westerhof et al., 2010, 04). When conducted within a group setting, it aims to encourage enjoyable and engaging interaction between the participants (Woods et al., 2005). It is suggested that SiR is able to increase life satisfaction, reduce anxiety, improve mood and encourage bonding (Hallford & Mellor, 2013; Westerhof & Bohlmeijer, 2014). The validity of this assertion will be examined in further detail later in the chapter.

This type of reminiscence utilises "cultural artefacts" which have been carefully chosen in order to evoke memories from when the older person was younger (Westerhof & Bohlmeijer, 2014). Lai, Chi, and Kayser-Jones (2004) define specific reminiscence as "highly focused use of triggers to approximate life history of an individual". The memory prompts which are chosen are an important consideration in SiR to ensure that the autobiographical memories evoked are those which are positive and activate

the social functions associated with reminiscence (Westerhof et al., 2010, 04; Westerhof & Bohlmeijer, 2014).

### 4.3.2 Life Review and Life Review Therapy

LR is defined by Dempsey et al. (2014) as “retrospective survey of existence, a critical study of a life, second look at one’s life”. It is a highly structured form of reminiscence (Subramaniam, Woods, & Whitaker, 2014), which is usually in the form of a life history which can be seen as the core of an individual's uniqueness (Haight et al., 2003). It is often seen as a natural process experienced by older people triggered by a realisation of their mortality (J.-J. Wang, 2005). It involves reflection on and reviewing their experience (Thorgrimsen et al., 2002; Coleman, 2005; Tadaka & Kanagawa, 2007; Trevitt & MacKinlay, 2004; Woods et al., 2005; Butler, 1963), with Azcurra (2012) perceiving it as a central task of ageing. However, both Coleman (2005) and Hsieh et al. (2010) are of the opinion that LR is an adaptive response triggered in older people who have experienced difficulties in life, with most individuals not necessarily requiring this form of adaptation, therefore, we can conclude that not all older people engage in this form of reminiscence.

Reminiscence assists the LR process (Haight et al., 2003), with both recent memories and remote memories recalled. It looks back on the reminiscer’s life, and reflects on experiences which have occurred, which can in some cases revive painful or unpleasant memories (Dempsey et al., 2014; Coleman, 2005; Subramaniam et al., 2014; Woods et al., 2005). However, the process aims to address any unresolved conflicts to achieve catharsis (Woods et al., 2005; Thorgrimsen et al., 2002; Su, Wu, & Lin, 2012) and come to terms with any issues which remain uncomfortable (Subramaniam et al., 2014). LR is often facilitated with a trained “therapeutic listener” who encourages repetition of the negative memories until the reminiscer has reached the point where they have achieved a sense of catharsis, are able to cope and seem ready to move on from the event (Subramaniam et al., 2014; Haight et al., 2003).

During the process of LR a systematic, chronological approach to the recall of memories is followed (Subramaniam et al., 2014; Westerhof et al., 2010, 04; Hallford & Mellor, 2013; Dempsey et al., 2014; Westerhof & Bohlmeijer, 2014; Su et al., 2012; E. Bohlmeijer, Valenkamp, Westerhof, Smit, & Cuijpers, 2005). It allows the participants to reflect on their development over the course of their life, together with how they have become the person they are today (Westerhof et al., 2010, 04; Hallford & Mellor, 2013). The LR process invokes the identity function of reminiscence (Westerhof et al., 2010, 04; Westerhof & Bohlmeijer, 2014; Coleman, 2005), encouraging the reminiscer to re-frame, re-interpret and integrate the positive and negative memories experienced during their life (Hallford & Mellor, 2013; Dempsey et al., 2014; Westerhof & Bohlmeijer, 2014; Haight et al., 2003; J.-J. Wang, Yen, & OuYang, 2009; J.-J. Wang, 2005), together with any lessons learnt as a result (Westerhof et al., 2010, 04). As a result of LR, the reminiscer can achieve a sense of integrity in life (Trevitt & MacKinlay, 2004), create



new meaning for memories in the present (Gonzalez et al., 2015), and gain a psychological balance (Su et al., 2012). This integration process also has the potential to soothe any residual pain which remains from adverse events, leading to reduced disturbance in the present (Haight et al., 2003). In addition, participants are encouraged to "deconstruct" any negative life events with the aim of painting them in a more positive light, possibly focusing on what has been learnt as a result of the experience in terms of development opportunities and enhanced wisdom (Coleman, 2005; Dempsey et al., 2014).

LR is often used to help people who are experiencing difficulty with finding meaning and those who are finding it challenging to cope with transitions or adversity in life (Westerhof et al., 2010, 04). Haight et al. (2003) suggest that this type of reminiscence is particularly useful in helping people live their life more freely. Dempsey et al. (2014) suggest that LR can be conducted throughout the lifespan, however, it is more commonly used with older people, and increases in frequency as a person ages (Haight et al., 2003). It is considered that the LR process requires a high level of inner skills to accomplish, which is not necessarily a characteristic of the ageing population (Dempsey et al., 2014; Coleman, 2005). It is expected that participants need to have the ability to carry out a number of tasks including reviewing their lives, selecting influential memories, summarising them, and evaluating their meaning, which may be too complicated for some people (E. Bohlmeijer et al., 2005). Therefore, people who are experiencing cognitive decline (which is present as a result of dementia) may be less effective at this type of reminiscence (Haight et al., 2003). Furthermore, those people who are experiencing severe dementia or extreme cognitive impairments may find great difficulty with the process, making LR infeasible (Subramaniam et al., 2014).

There are several goals of the LR process, including: enhancing self acceptance (Westerhof et al., 2010, 04; Hallford & Mellor, 2013; Azcurra, 2012), improving mastery (Westerhof et al., 2010, 04), boosting meaning in life (Westerhof et al., 2010, 04; Dempsey et al., 2014; Su et al., 2012; Subramaniam et al., 2014; Hallford & Mellor, 2013), encouraging integration to create a sense of cohesion and continuity in life (Hallford & Mellor, 2013; Dempsey et al., 2014; Woods et al., 2005; Thorgrimsen et al., 2002; E. Bohlmeijer et al., 2005), and evoking a process of change in physical, mental and social activities (Tanaka et al., 2007). Furthermore, it is suggested that LR helps the reminiscer to recall any past values and coping strategies that have previously guided them, thus evoking the problem solving functions of reminiscence (Westerhof et al., 2010, 04; Westerhof & Bohlmeijer, 2014; Coleman, 2005; Hallford & Mellor, 2013). This have the potential to lead to an enlightening process which can result in a transformation of both goals and values (Dempsey et al., 2014; Coleman, 2005), re-energising the reminiscer to continue in life and progress to new things (Haight et al., 2003).

LR is shown to be effective at improving life satisfaction (Hallford & Mellor, 2013; Su et al., 2012), together with both psychological and spiritual well-being (Hallford & Mellor, 2013; Azcurra, 2012). However, the editorial by Coleman (2005) suggests that interventions based on LR were not associated with life satisfaction, contradicting the findings of Su et al. (2012). More research is required to confirm

whether LR does have an impact on life satisfaction as the sample included in the study conducted by Su et al. (2012) involved patients who were quarantined in a leprosy sanatorium for over 30 years, which could skew the results. Furthermore, Haight et al. (2003) conducted a study investigating the effects of dyadic LR, finding that the intervention lead to reduced care-giver burden due to a reduction in problem behaviours and an improvement in the mood of the PwD despite a decline in their condition. However, care needs to be taken when interpreting these results, particularly the mood improvement, as the ratings were as observed by the care-giver, rather than self-report, which could lead to a bias in the results based on the feelings of the carer. Hence, further research is required to be able to conclusively define the benefits and effectiveness of participation in LR activities.

Haight et al. (2003) suggest that there are four factors which contribute to an effective LR intervention: time, individuality, structure, and evaluation, which is broadly aligned with the comments of Subramaniam et al. (2014) and Woods et al. (2005). The amount of time is something which is not definitive in the literature, with Haight et al. (2003) stating that it should last for a minimum of two months and Dempsey et al. (2014) implying the intervention should last between 6 and 8 weeks. However, Dempsey et al. (2014) do recognise that the number of LR sessions should depend on the needs of the reminiscer. It is often the case that LR is lead by a professional who is trained to utilise counselling techniques to guide the interactions (Dempsey et al., 2014; Hallford & Mellor, 2013) and listen with empathy (Haight et al., 2003), ensuring the sessions are guided, structured and targeted (Haight et al., 2003; Subramaniam et al., 2014; Hallford & Mellor, 2013). Formal LR interventions tend to be designed to support those people who would benefit from gaining integrity in relation to their past, but are unable to conduct the process independently and require support (Cotelli et al., 2012).

### 4.3.3 Spiritual Reminiscence

SpR is a form of reminiscence which utilises techniques to evoke memories with the purpose of facilitating the search for meaning in a life lived (Trevitt & MacKinlay, 2004). In addition, it allows people to find meaning in life at the present time of their life (MacKinlay & Trevitt, 2010; Wu & Koo, 2015). SpR acknowledges the importance of spirituality in later life (Wu & Koo, 2015). Furthermore, SpR allows PwDs to recognise their integrity and worth in light of declining cognitive abilities (MacKinlay & Trevitt, 2010).

The use of SpR has been suggested as appropriate for people with declining cognitive abilities, as it does not require any new skills to be learnt, is non-pharmacological, and is considered to be a non-invasive intervention (Wu & Koo, 2015). In contrast, Trevitt and MacKinlay (2006) suggest that the onset of dementia makes assigning meaning and working through the process of SpR difficult for PwDs, due to their decline in cognitive functioning. However, recent research by Wu and Koo (2015) seeks to oppose this finding, implying that PwDs are able to contribute to, and obtain benefit from,

SpR. Despite utilising a controlled trial with a sample size of 103 PwDs (control N=50, intervention N=53), there needs to be additional research in order to validate the findings of this study before it can be generalised. In addition, the participants involved were diagnosed with mild-to-moderate dementia, therefore, it cannot be assumed that all PwDs are able to participate, as there has been no consideration about those who have reached a more severe stage of dementia. Hence, it cannot be assumed that PwDs will all be able to actively contribute to the SpR process.

The aim of SpR is to connect with another person on a more meaningful and personal level, thus, providing way of working effectively with older people to aid them in the process of finding meaning in life as they approach their final years (MacKinlay & Trevitt, 2010). As such, it is not necessary for the participants to hold religious beliefs to contribute to SpR (Wu & Koo, 2015).

As older people approach the end of their life and become increasingly aware of their own mortality, the need to find meaning in life becomes more urgent (Trevitt & MacKinlay, 2004). Due to a decline in their cognitive abilities, PwDs often experience issues relating to establishing meaning in life (MacKinlay & Trevitt, 2010; Wu & Koo, 2015; Trevitt & MacKinlay, 2004). The use of SpR allows them to reconnect and enhance meaning in their life through the reviewing of their life and contemplating any hopes they have for the future (MacKinlay & Trevitt, 2010). Furthermore, it is suggested by Wu and Koo (2015) that the use of SpR can allow PwDs to transcend the limitations associated with their conditions, thus, finding hope, achieving acceptance their lives and rediscovering the inner strength required to cope with their changing circumstances (Wu & Koo, 2015; Trevitt & MacKinlay, 2006). The emphasis of SpR is to consider the meaning which can be assigned to memories, rather than simply describing the events which have occurred throughout their life span (MacKinlay & Trevitt, 2010; Trevitt & MacKinlay, 2006). As such, the identity functions of reminiscence are invoked rather than those which are considered social.

It is suggested that the use of SpR can help older people develop strategies to accept the changes, such as loss of significant relationships and a reduction in feelings of independence, which occur in the later years of their life (MacKinlay & Trevitt, 2010; Wu & Koo, 2015). It provides people with the opportunity to share concerns they hold and discuss their hopes for the future (MacKinlay & Trevitt, 2010; Wu & Koo, 2015; Trevitt & MacKinlay, 2006). PwDs are encouraged to analyse whether their spiritual needs have been met, and discuss what they are looking forward to as the end of their life approaches (MacKinlay & Trevitt, 2010; Trevitt & MacKinlay, 2006)

Research by Wu and Koo (2015) did find that when SpR is conducted within a small group setting it assisted the fostering of new relationships between the participants. This connection was also discussed by MacKinlay and Trevitt (2010) and Trevitt and MacKinlay (2006) in their earlier research, suggesting that SpR may be effective at allowing people to form new connections. It is suggested that three elements are required to make SpR effective: effective facilitators of the intervention, a supportive

environment, and small groups (MacKinlay & Trevitt, 2010; Trevitt & MacKinlay, 2006, 2004). In addition, Trevitt and MacKinlay (2004) suggest that people are willing to actively contribute provided that they have someone willing to listen to them and are given time to express their beliefs at their own rate. The use of a supportive and protective environment allows PwDs to discuss meaningful issues without experiencing communication which is patronising, superficial and trivial, as they usually would (MacKinlay & Trevitt, 2010; Wu & Koo, 2015).

The use of SpR can help people identify any feelings of guilt, anger and regret within their past (MacKinlay & Trevitt, 2010; Wu & Koo, 2015). Subsequently to the discovery of these types of memory, the participants are encouraged to reframe and reassess these memories in order to move to a higher level of understanding of the meaning and purpose of their life as it has been lived, allowing them to achieve a sense of closure and integrity in their journey (Trevitt & MacKinlay, 2004; MacKinlay & Trevitt, 2010; Wu & Koo, 2015).

#### **4.3.4 Research Focus**

The aim of this project will be to evoke the SiR type of reminiscence. As demonstrated earlier in this section, the use of LR requires a trained professional to guide the reminiscence intervention. This is not something which can be implemented in a technology-supported reminiscence programme. Whilst Wu and Koo (2015) demonstrated that PwDs are able to actively contribute to SpR interventions, the main aim is to assign meaning to memories rather than to evoke positive memories. Furthermore, the main focus of the reminiscence intervention developed as part of this research project is to improve feelings of happiness for PwDs and their care-givers, which is the purpose of conducting SiR. In addition, this type of reminiscence is one which can be conducted without the intervention of a trained professional.

### **4.4 Benefits of Reminiscence**

There has been much discussion relating to the potential benefits of RT, as a non-pharmacological alternative to treating PwDs who experience psychosocial symptoms. Whilst the results remain inconclusive (Tadaka & Kanagawa, 2007; Brooker & Duce, 2000; Baillon et al., 2005; O'Shea et al., 2014; Lai et al., 2004; Hsieh et al., 2010; Cotelli et al., 2012; Azcurra, 2012; Tolson & Schofield, 2012), there is some suggestion that RT can be of benefit to both the PwD and their care-givers (Jo & Song, 2015; Gonzalez et al., 2015; Mulvenna et al., 2011; Chao et al., 2006; Testad et al., 2014, 07; Song-Lin, Chih-Ming, Chiu-Yen, & Chen, 2009; Okumura et al., 2008; J.-J. Wang, 2007). The inconclusive nature of reminiscence research was also observed by Woods et al. (2005) when they conducted their Cochrane review of RT, which utilised a meta-analysis of randomised controlled trials and quasi-randomised trials to evaluate the effectiveness of RT. However, continued use of RT is recommended

due to its popularity and anecdotal evidence of benefit (Dempsey et al., 2014; Woods et al., 2005). In addition, it is suggested by Haslam et al. (2010) that it is unclear what has caused the improvements in the outcome measures, with the change potentially attributed to group membership rather than the intervention itself (Haslam et al., 2010; Tolson & Schofield, 2012). Another challenge associated with reminiscence research is the lack of correlation between anecdotal and quantitative evidence. It has often been the case that comments made by staff with regard to the improvements do not match the results found when using quantitative measures (Coleman, 2005; P. T. Wong & Watt, 1991; Brooker & Duce, 2000).

Part of the inconsistency between the results can be attributed to the varying definitions used to describe reminiscence and a wide variety of research methodologies employed (Dempsey et al., 2014; Lai et al., 2004; Westerhof et al., 2010, 04). It has been suggested by Woods et al. (2005) that better designed studies are required in order to conclusively establish the effectiveness and benefit of interventions based on RT. This would include the use of more rigorous controlled trial methodologies (Lai et al., 2004; Westerhof & Bohlmeijer, 2014; Haslam et al., 2010), more precise definitions of reminiscence (Westerhof et al., 2010, 04; Dempsey et al., 2014), more precise measurements (Westerhof et al., 2010, 04), and larger sample sizes. The fact that multiple studies aim to assess different outcomes and utilise a wide variety of measures makes comparing studies challenging. Therefore, more studies with larger sample sizes and consistent outcome measures are required before conclusive and validated evidence can be obtained.

Reminiscence is seen as a popular intervention, particularly in residential nursing homes (Woods et al., 2005). The appeal of this intervention lies in its non-stigmatising, cost-effective and easy-to-implement nature (Hsieh et al., 2010; E. Bohlmeijer et al., 2005). In addition, the intervention provides older people with an easy and age-appropriate intervention to engage in (Woods et al., 2005).

RT is described as an intervention which is of minimal risk to participants (Sharif et al., 2010). There are cases where no harmful effects of reminiscence have been reported (e.g. Azcurra, 2012), as discussed by Woods et al. (2005) in their Cochrane review of RT. However, it is important to recognise this is not a risk-free intervention. RT has the potential to evoke both positive and negative memories (Dempsey et al., 2014; Subramaniam et al., 2014). Due to the nature of the interventions, the likelihood of experiencing negative emotions is increased when people are engaging in LR and LRT (Subramaniam et al., 2014). Furthermore, research by Cappelliez et al. (2005) suggests that a large proportion of all naturally occurring reminiscences were a result of negative emotions, with Dempsey et al. (2014) suggesting this figure is 67%. Whilst, it is argued that these negative memories, need to be "faced" (Haight et al., 2003), care needs to be taken to ensure that the people reminiscing are supported appropriately to ensure they don't become overwhelmed and spiral further into a depressed state (Mulvenna et al., 2011; Dempsey et al., 2014; Grasel et al., 2003). A knowledge of the PwD will allow potential problems to be avoided before they occur (Dempsey et al., 2014). Through the

inclusion of relatives and informal care-givers, the PwD can be adequately supported throughout the reminiscence process.

There is increasing evidence that any benefits experienced only last for a short period of time (Ashida, 2000; Tadaka & Kanagawa, 2004; J.-J. Wang, 2007), in some cases, only for the duration of the RT intervention (Grasel et al., 2003). In order to counteract this effect, it is suggested that RT is performed over a longer period of time (Lai et al., 2004; Sharif et al., 2010; J.-J. Wang, 2007; Tadaka & Kanagawa, 2007). There is, however, a lack of evidence to demonstrate whether sustained participation in RT does maintain the effect. Therefore, further research is required over a longer period of time to assess whether the benefits experienced are maintained, or whether the PwD becomes accustomed to the intervention, potentially reducing the effects felt.

#### 4.4.1 Mental Health

It has long been suggested that reminiscence has the potential to support the mental health of older people (Westerhof & Bohlmeijer, 2014), and has been described as a “popular approach to promoting older people’s mental health” (Coleman, 2005). In a controlled study conducted by W. Zhou et al. (2012), it was found that group RT is effective in improving the participants mental health. However, this is one of few controlled trials which investigate the impact of reminiscence on mental health and does not consider PwDs in their sample, only depressed adults. Hallford and Mellor (2013) implies that the effect on mental health experienced is an indirect effect of reminiscence, resulting from the influence of self-perception resources.

Depression frequently occurs in older people and is often observed as a co-morbidity to dementia (Ashida, 2000). A research study conducted by J.-J. Wang (2005) found that over half the older people living in residential care who were sampled experienced depressive symptoms. Reminiscence is often cited as a method for alleviating depression in older people (Westerhof et al., 2010, 04; Hallford & Mellor, 2013; Dempsey et al., 2014; Westerhof & Bohlmeijer, 2014; Baillon et al., 2005; Tadaka & Kanagawa, 2007; Woods et al., 2005; Cotelli et al., 2012; Testad et al., 2014, 07; Jo & Song, 2015). However, there remains conflict regarding how long the effects of RT last. Research by Hallford and Mellor (2013) found that the decrease in depressive symptoms was maintained six months after the intervention. Furthermore, Sharif et al. (2010) observed that the levels of depression had increased one month after the intervention period was complete, but did recognise that the symptoms were less than prior to treatment. This suggests that whilst reminiscence may reduce significantly immediately after the interventions, the symptoms will gradually intensify without maintenance. Additionally, research by Tanaka et al. (2007) observed that patients smiled more when engaging in reminiscence interventions. Whilst this is qualitative rather than quantitative and doesn’t guarantee that the participants experienced reduced depressive symptoms, it is a positive outcome. When implementing RT interventions to treat depression,

care needs to be taken to ensure that it remains managed, otherwise it can be used to reinforce depressive symptoms (Mulvenna et al., 2011). The management of RT interventions must ensure that people are encouraged to avoid the negative functions, especially boredom reduction and bitterness revival. Therefore, whilst the research suggests that RT can be effective, particularly for people with clinical depression (Westerhof & Bohlmeijer, 2014; Su et al., 2012), care needs to be taken to ensure that it is correctly implemented to guarantee a positive outcome.

Dementia can potentially have a detrimental effect on the mood of a person. It is suggested by Westerhof and Bohlmeijer (2014) that the act of recollecting memories which are personal to the reminiscer can lead to an increase in positive emotions. Testad et al. (2014, 07) highlight the importance of activities which are considered to be pleasant both with and without social interactions for the improvement of a person's mood. There is research which suggests that PwDs can experience an improvement in their mood as a result of engaging in reminiscence activities (Haslam et al., 2010; Baillon et al., 2005). However, there needs to be some care taken when interpreting these results, as the Baillon et al. (2005) utilised a small sample size ( $N=20$ ), and the measure used to assess the mood of the PwD used observational techniques, rather than self-report methods, which may introduce a researcher bias. In addition, research by Ashida (2000) found that the positive improvement in mood was not sustained in the long term. This can be contrasted with the Cochrane review conducted by Woods et al. (2005) found that the improvement in mood was not significant at the end of the intervention period, but was significant at follow up. This contradiction suggests that further research is required to establish whether any improvement in mood can be sustained over a longer period of time.

It is often reported that older people derive pleasure from the act of reminiscence (Brooker & Duce, 2000; Haight et al., 2003; Hsieh et al., 2010), with the activity being an enjoyable pastime (Baillon et al., 2005; J.-J. Wang, 2007; Tolson & Schofield, 2012). Research by Okumura et al. (2008) found that participants in a reminiscence intervention group reported feeling happier when compared to a conversation group. However, whilst this study did include PwDs, the sample size for each group was six participants. Therefore, before conclusions can be drawn from this study, further research is required to replicate the results on a larger scale. Furthermore, other studies have found that an increase in positive emotions was experienced after engaging in reminiscence interventions (Song-Lin et al., 2009; Nakamae, Yotsumoto, Tatsumi, & Hashimoto, 2014; W. Zhou et al., 2012; Chao et al., 2006), with reminiscence perceived as responsible for generating "positive emotional experiences" (Cappeliez et al., 2007). However, Haight et al. (2003) report that the positive emotions experienced are only fleeting.

### 4.4.2 Well-being

Well-being is a difficult concept to define, with no clear definition across the literature (Dodge, Daly, Huyton, & Sanders, 2012). This makes comparing findings relating to well-being particularly challenging, as the authors will all have different interpretations of its meaning. In addition, there are few authors who define what they mean when they use the term well-being when reporting results, making the measures they use of particular importance. As a result of declining capacities, PwDs often experience a decline in their levels of well-being. Hence, Lai et al. (2004) state that it is important that interventions which aim to alleviate this are developed and validated. There have been many studies where the researchers have obtained results which demonstrate a significant improvement of a person's well-being subsequent to participating in RT (e.g. Brooker and Duce, 2000; Hallford and Mellor, 2013; J. C. C. Chung, 2009). In particular, LR and life-story approaches appear to have "fairly convincing" evidence that it can lead to an improvement (Lai et al., 2004; O'Shea et al., 2014; Subramaniam et al., 2014). It is additionally suggested that many of the benefits associated with this type of intervention have the potential to improve well-being in their own right (Dempsey et al., 2014; Gonzalez et al., 2015), possibly enhancing the effects experienced. Research by Lai et al. (2004) also implies that there may be a trend towards the positive effect experienced being sustained over a period of six weeks, although these results did not reach a significant level. Whilst the majority of studies conducted to investigate the effect of RT on well-being demonstrate positive results, care needs to be taken to ensure a consistent definition is used before declaring that the intervention improves a PwD's level of well-being.

A diagnosis of dementia has the potential to reduce the QoL for PwDs, with people who are residing in permanent care having lower levels than those who live in the community (Jo & Song, 2015). However despite their declining condition, PwDs are still able to experience improvements in their QoL (Subramaniam et al., 2014), something which is important to maintain (Haslam et al., 2010). There is some research which suggests RT is able to support and improve the QoL of PwDs. Several studies have demonstrated a significant improvement in the QoL scores of PwDs (Okumura et al., 2008; Azcurra, 2012; Jo & Song, 2015; J. C. C. Chung, 2009), implying that reminiscence can have a positive effect. However, of these four studies, only one was conducted using a controlled trial methodology, making it difficult to draw the conclusion that the participation in RT improved the QoL. Whilst O'Shea et al. (2014) did obtain a significant improvement in QoL, this was only when a per-protocol approach was followed, which can lead to biased results (Shah, 2011). Therefore, this result should be approached cautiously, particularly when the intention-to-treat result was not considered significant. The study does, however, demonstrate a positive trend towards the effectiveness of RT at improving QoL. Research by Subramaniam et al. (2014) found that PwDs who received a life story book (LSB) also experienced an improvement in QoL, regardless of whether they had engaged in the development process. This



indicates the reminiscence rather than LR contributes to the improved QoL. However, this is only one study, therefore, further research which aims to replicate this finding is required before firm conclusions can be drawn. It would appear that reminiscence has the potential to improve QoL for PwDs, however, further controlled trials are required before a definitive conclusion can be drawn.

A person's sense of identity could be harmed due to cognitive decline (Dempsey et al., 2014) and a loss of autonomy (Grasel et al., 2003), which can also lead to a loss of self awareness (Gonzalez et al., 2015). It is suggested that memory plays an important role with regard to construction and maintenance of self image (Coleman, 2005; Gonzalez et al., 2015; Hsieh et al., 2010). This maintenance of identity is made particularly difficult for PwDs as an absence of memories from the middle years of life can lead to feelings of disconnection between the past and the present (Woods et al., 2005). Reminiscence can be utilised to tap into the earlier memories, thus restoring a sense of where the person has come from, demonstrating the changes which have occurred over time and lead them to becoming the person they are today (Dempsey et al., 2014; Baillon et al., 2005). In addition, this sense of identity can be improved through cherishing existing memories (Grasel et al., 2003). There is research which suggests that engagement in RT interventions can improve self identity (Dempsey et al., 2014; Song-Lin et al., 2009; Gonzalez et al., 2015; Tolson & Schofield, 2012; Chao et al., 2006). However, only one study seeks to measure this effect quantitatively, finding that there was a significant strengthening of personal identity in the participants of the RT intervention (Haslam et al., 2010). Therefore, further research is required to validate this finding before conclusions can be established for the entire population. Furthermore, research conducted by MacKinlay and Trevitt (2010) found that older people who live in residential care prefer to participate in interventions which reinforce their sense of identity. However, this research requires further validation, and does not take into account whether the same result would be found for people who live in the community.

Meaning in life can be described as having two definitions: a coherent cognitive interpretation of life and a purposeful direction in life (Dittmann-Kohli & Westerhof, 1997, cited by E. Bohlmeijer, Westerhof, and Jong, 2008). Both depression and dementia can have a negative effect on one's concept of their meaning in life (E. Bohlmeijer et al., 2008). There is some suggestion that reminiscence can have a positive impact on meaning in life for older adults, particularly when the LR intervention is utilised (Dempsey et al., 2014; Westerhof & Bohlmeijer, 2014; Chao et al., 2006), with the intervention leading some participants to maintain their relationship with their past (Gonzalez et al., 2015) and to feel that their life had been "worthwhile" (J. C. C. Chung, 2009). Research suggests that reminiscence can help older people re-establish a sense of meaning in life (Westerhof et al., 2010, 04; Dempsey et al., 2014), however, these studies are few, and have yet to be replicated. In addition, the participants included in the studies were not PwDs, making drawing a conclusion with regards to effectiveness in this user group difficult.

The diminished autonomy which results from dementia can lead to a reduction of a person's self esteem

(Grasel et al., 2003). It is thought that respecting what a person says through the use of reminiscence can increase their self-esteem (Dempsey et al., 2014; Chao et al., 2006; Chueh & Chang, 2014; Baillon et al., 2005; Jo & Song, 2015; Hsieh et al., 2010; Tolson & Schofield, 2012), with the RT acting as a self-enhancing process (Westerhof & Bohlmeijer, 2014). In contrast, W. Zhou et al. (2012) found no significant effect of RT on the self-esteem of PwDs. The authors suggest that this contrasting result could be due to a difference in sampling methodologies. Whilst it would appear that engaging in activities involving RT may improve self-esteem for older people living with dementia, the study results are contradictory, implying that more quantitative research is required to provide conclusive evidence of an improvement.

#### 4.4.3 Cognitive Skills

One of the main symptoms associated with a diagnosis of dementia is a decline in cognitive functioning. RT provides people with an opportunity to engage in cognitive stimulation (Chao et al., 2006). The evidence for whether RT is effective at improving cognition is contradictory and has been described as “controversial” (Su et al., 2012). There are a number of studies which demonstrate an improvement (Tadaka & Kanagawa, 2004, 2007; J.-J. Wang, 2007; Tanaka et al., 2007; Song-Lin et al., 2009). However, there are others which demonstrate no change in cognitive functioning (Tadaka & Kanagawa, 2007; Su et al., 2012). Whilst the studies conducted by Thorgrimsen et al. (2002) and J. C. C. Chung (2009) found no improvement in cognition, they did find that the participant’s condition stabilised. In the case of Thorgrimsen et al. (2002), the corresponding control group experienced a deterioration suggesting that the RT intervention prevented a decline in functioning. However, care needs to be taken when interpreting this result, as the study was intended to act as a pilot study. Furthermore, it is suggested that engaging in RT can result in improvements to autobiographical memory (Subramaniam et al., 2014; Cotelli et al., 2012). However, whilst the study conducted by Cotelli et al. (2012) was controlled, the sample size is small, making extrapolating the conclusion to the general population. Overall, the evidence that RT impacts the cognitive functioning of PwDs is inconclusive and requires further large sample, quantitative studies to demonstrate the benefit of the intervention.

PwDs often experience a rapid decline in their ability to communicate verbally (Jo & Song, 2015). It is suggested that RT can be used to stimulate conversation (Woods et al., 2005; Sharif et al., 2010). There is some evidence that engaging in reminiscence can improve communication skills (Haslam et al., 2010; Baillon et al., 2005; Tadaka & Kanagawa, 2007; Jo & Song, 2015; Thorgrimsen et al., 2002; Chueh & Chang, 2014; J. C. C. Chung, 2009) and increase conversational fluency (Ashida, 2000; Okumura et al., 2008). Research conducted by Okumura et al. (2008) found that an increased number of words were recalled after engaging in RT. This result was significant after three sessions of reminiscence. The large number of studies which have found that communication is improved through RT implies that it is a beneficial intervention for PwDs. However, in all the studies, the sample size is reasonably small.

In addition, there were very few studies which used quantitative measures to assess the improvement of conversational and communication skills. Therefore, future research is required in order to assess whether participation in reminiscence interventions can have a measurable effect on PwDs.

It is said that a lack of stimulation and engagement can have a disabling effect on PwDs (Tolson & Schofield, 2012). Reminiscence, particularly when structured to correlate with the person's life experiences, is able to improve both attention (Tanaka et al., 2007; J. C. C. Chung, 2009) and engagement (Tolson & Schofield, 2012; J. O'Rourke, Tobin, O'Callaghan, Sowman, & Collins, 2011). In addition, Azcurra (2012) found that when a life story approach was adopted, levels of attention improved significantly. Furthermore, Ashida (2000) found that active participation in the group increased for PwDs who had lower levels of functioning. However, there was no corresponding increase for participants with a higher level of functioning, which Ashida attribute to the high levels of engagement from the beginning of the intervention. Whilst the results of all these studies seem to demonstrate that reminiscence can lead to a greater sense of engagement, with the exception of the research conducted by Azcurra (2012), the sample sizes are relatively small. In addition, Tolson and Schofield (2012), J. O'Rourke et al. (2011) and Tanaka et al. (2007) utilise a case study approach, with very small sample sizes. Whilst all the studies indicate a trend towards reminiscence proving beneficial in relation to engagement and attention, more research is required, with larger sample sizes and quantitative methodologies before any firm conclusions can be drawn.

Reminiscence has the potential to contribute towards psychological adaption of older people (Song-Lin et al., 2009; J.-J. Wang, 2005). In their concept analysis of reminiscence for PwDs, Dempsey et al. (2014) suggest that providing a sense of fulfilment and achievement can support the natural adaptation process which occurs in response to ageing. It is believed that PwDs do retain the ability to easily adapt to their changing circumstances with only a small amount of practice (Okumura et al., 2008). However, the use of reminiscence may support people to implement practices that were previously considered lost but have been revived through RT (Gonzalez et al., 2015), particularly when the problem solving functions are evoked. Whilst it is thought that reminiscence can support the adaptation process, there is minimal research in this area. It would be beneficial to evaluate whether RT can evoke adaptation in older people living with the condition. However, the measurement of this particular benefit will be challenging and will require considerable thought as to whether adaptation is quantifiable and measurable in an accurate and replicable way.

#### **4.4.4 Behavioural Benefits**

Behavioural challenges are a well documented symptom associated with a diagnosis of dementia. RT is regularly cited as a potential solution to managing the behavioural problems which manifest in PwDs (e.g. Dempsey et al., 2014; Tadaka and Kanagawa, 2004; Gonzalez et al., 2015), with pleasant activities

reported to be important when treating agitation (Testad et al., 2014, 07). There are studies which have demonstrated a statistically significant reduction in instances of challenging behaviours (Baillon et al., 2004; Thorgrimsen et al., 2002) and agitation (van Diepen et al., 2002). In addition, J.-J. Wang et al. (2009) found a positive change in social disturbance behaviours, but no significant difference in overall behaviour competence. However, in all three studies which found statistical significance, the sample size is relatively small. There are further studies which tend towards a positive outcome of RT interventions for PwDs (J.-J. Wang et al., 2009; Cotelli et al., 2012), however, these studies do not obtain statistically significant results. Whilst the evidence is thin, there is a trend towards demonstrating the effectiveness of RT to manage the behavioural challenges associated with dementia.

The diagnosis of dementia often leads to withdrawal from social interactions and a reduced friendship base (Tadaka & Kanagawa, 2004, 2007; J. C. C. Chung, 2009). Attendance at RT sessions provides a safe environment for PwDs and their care-givers to interact with other people, where differences in cognitive abilities can be accounted for (Ashida, 2000; Brooker & Duce, 2000). This “highly interactive” activity allows people who would previously have been excluded from participating in group activities to make a meaningful contribution (Brooker & Duce, 2000). RT gives a basis for new connections and aiding in the maintenance of existing relationships, through the sharing of memories, the establishment of common ground, and the provision of mutual support (J. C. C. Chung, 2009; Tadaka & Kanagawa, 2007; Haight et al., 2003; Dempsey et al., 2014). Whilst RT is regularly cited as an activity which improves socialisation, there are very few studies which demonstrate this. However, research by Tadaka and Kanagawa (2007) found significantly lower levels of withdrawal in the intervention group receiving RT when compared to a control group. For people living with Alzheimer’s disease, the effects were only experienced in the short-term, whereas participants with vascular dementia were able to sustain the effect for 6 months after the completion of the intervention period (Tadaka & Kanagawa, 2007). In addition, Song-Lin et al. (2009) found that people receiving RT experienced increased feelings of participation. However, as part of a research project, these feelings of participation may have been a result of being included within the study, rather than as a direct result of the intervention itself. Finally, improved social behaviour and engagement have been demonstrated (Jo & Song, 2015; Azcurra, 2012; Chao et al., 2006), with Chao et al. (2006) observing that participants became more involved with each other and engaged in more interactions both within the group and outside it. However, in all these studies, the sample size is relatively small, making extrapolation to the general population difficult.

#### **4.4.5 Care-giver Related Benefits**

In addition to the benefits experienced by PwDs, the care-givers also gain some advantages from participation in reminiscence therapy. Often, when a person is caring for someone who is living with dementia, they become focused on carrying out day-to-day activities, leaving minimal time for interaction. This is particularly experienced within the residential care environment, where a lack of staffing can reduce

the amount of time which can be spent with patients, limiting the interaction to what is required to complete a specific task. However, research suggests that reminiscence is able to encourage greater levels of interaction and foster the bond between PwDs and their care-givers (Dempsey et al., 2014; Westerhof & Bohlmeijer, 2014; Song-Lin et al., 2009). Through an increased awareness and knowledge of a person's past, the care-givers are able to build a greater rapport with the patient, and are able to implement a person-centred care plan (Baillon et al., 2005; MacKinlay & Trevitt, 2010). Research by Subramaniam et al. (2014) found that there was a significant increase in the amount of knowledge of the PwD after a course of RT interventions when compared to before. Whilst the sample size is relatively small (with only 23 participants), a review conducted by Woods et al. (2005) identified two further studies which demonstrated this increase. In addition, Subramaniam et al. (2014) found that the care-giver's attitude towards the PwD improved after they had seen a life story book for the patient. This improved attitude towards the PwD was also identified by J. C. C. Chung (2009), who used an intergenerational reminiscence program to foster relationships between young people and those who were living with dementia. In addition to the advantages experienced by professional care-givers, family members who are caring for the PwD in the community also demonstrated an increased level of understanding and a stronger bond with their relative (J. O'Rourke et al., 2011; Chao et al., 2006). The evidence suggests that the use of reminiscence interventions may lead to a more positive relationship between the care-giver, whether professional or informal, and the PwD.

As a result of a dementia diagnosis, partners or family members often become care-givers for the PwD. This can lead to a feeling of strain and burden on the family members. However, research suggests that participation in RT may be able to reduce the strains experienced by the care-giver (Thorgrimsen et al., 2002; Azcurra, 2012), thus minimising the burden felt (Jo & Song, 2015). Furthermore, this reduction in the strains associated with care-giving was found to lead to the family members being able to deal with the diagnosis and associated change in circumstances (Grasel et al., 2003). The results of the study conducted by Thorgrimsen et al. (2002) found a significant reduction in the strain experienced by the care-givers of PwDs. However, this study was a pilot study, hence, the results found can only indicate that there may be trend towards reduced burden which warrants further investigation. Azcurra (2012) conducted research which does appear to validate the findings of Thorgrimsen et al. (2002). However, the strain experienced by the care-givers is self-report, rather than quantitative. Therefore, it can be recommended that future research should seek to validate the pilot study and quantitatively evaluate effectiveness of RT in reducing care-giver burden.

## 4.5 Conclusion

This chapter has demonstrated that there are various functions of reminiscence, which can have a negative or positive influence on the reminiscer. Research suggests there are eight functions of remi-

niscence: identity, problem solving, bitterness revival, boredom reduction, teach-inform, conversation, death preparation, and intimacy maintenance. Of these eight functions three are considered to be positive (identity, problem solving, and death preparation), three negative (bitterness revival, boredom reduction, and intimacy maintenance), and two social (teach-inform and conversation). As the aim of the developed reminiscence program is to evoke positive emotions, the positive and social functions will aim to be utilised. In addition, the negative functions will be avoided, to reduce the likelihood of the program having a detrimental impact on the PwD.

It can be considered that there are four main types of reminiscence: SiR, LR, LRT, and SpR. This research will aim to utilise the SiR type of reminiscence. As discussed earlier in this chapter, the LR and LRT require trained therapist to implement the interventions, ensuring the PwD is successfully guided through their life history. In addition, as discussed earlier SpR relies on small group interventions with an effective facilitator, and a supportive environment. As an at-home reminiscence program with no professional support, these types of reminiscence would be an inappropriate to implement.

Despite the lack of empirical evidence, there are some indications that reminiscence may provide benefit to PwDs and their care-givers. This chapter has found that there are five main groups of benefits of reminiscence for PwDs and older people: mental health, well-being, cognitive skills, behavioural benefits, and care-giver benefits. However, research into RT has three main limitations: small sample sizes, short study lengths, and variability in the techniques used to measure the variables examined. Firstly, it is often the case in research relating to RT interventions that the sample sizes are too small to extrapolate any significant findings to the general population. Secondly, most research shown has been conducted over a short period of time. This makes demonstrating whether RT has a sustained benefit for PwDs difficult. Finally, the various studies utilise different measures for the same variables, making comparisons difficult. Therefore, further research is required with larger groups of participants, which occur over a longer period of time, with consistent measures are required to conclusively demonstrate whether RT is of benefit to PwDs and their care-givers.

However, as highlighted by MacKinlay and Trevitt (2010), it is important to recognise that this intervention may not be suitable for everyone, as not all people will want to engage in reminiscence of the past, particularly if they are viewing their history in a negative light. At all points, the wishes of the participants should be respected, if they are unwilling to take part in the process they should not be coerced. At the core of reminiscence is "a respect for the person, as an individual, with a unique life history" (Woods et al., 2005), therefore, respecting the wishes and life history of the person, is a fundamental element of the process. This respect also ties in with Kitwood's concept of person-centred care which aims to ensure the patient's personhood is placed at the centre of all decisions.

The remainder of this thesis will aim to develop a theory-based reminiscence program which can be implemented on a tablet computer. The following chapter will extend the knowledge gained within

this review of RT, aiming to investigate the types of stimuli which evoke memories. In addition, it will assess the types of memory which should be used to foster positive emotions.

## CHAPTER

# 5

# THE PERCEPTION OF MEMORIES

## 5.1 Introduction

As seen in the previous chapter, reminiscence involves the evoking of memories. The overall aim of this research is to develop a program of positive reminiscence which can be implemented using recent advances in technology. In order to develop this program, a knowledge of what elicits positive memories will be required. The study described within this chapter aims to address this knowledge requirement. Through the use of a questionnaire, this study will aim to investigate which types of memory should be supported and encouraged within the program for reminiscence.

It is suggested that emotional memories evoke frequent rumination and rehearsal (Allen, Schaefer, & Falcon, 2014), with the repetition making them more ingrained in the memory of the person (Coluccia, Bianco, & Brandimonte, 2010). For PwDs, this rehearsal of memories will make them easier to recall, thus, leading to a greater ability to fully participate in reminiscence activities. Furthermore, research suggests that memories which evoke positive emotions can be an effective repair technique to minimise, or eliminate, feelings of sadness and negative emotions (Seebauer et al., 2016; C. Chen, Takahashi, & Yang, 2015), thus supporting the person to regulate their mood (C. Chen et al., 2015).

Positive emotions in themselves are described as “functional” (Shiota et al., 2014). They are cited as benefitting well-being, supporting the maintenance of social and emotional bonds, and in some cases, having a positive effect on the physical health of the person (Shiota et al., 2014; C. Chen et al.,



2015). As people grow older, they gain a positive bias towards their memories (Otake, 2015), which has links to the positivity effect associated with Socio-Emotional Selectivity Theory (SES). SES states that during their life a person has two motives: emotion regulation and information gain (Westerhof et al., 2010, 04). When people grow older, the emphasis transfers from gaining information to the regulation of emotions, in order to give the person a greater sense of well-being (Westerhof et al., 2010, 04; Cappeliez & O'Rourke, 2006). The result of the positivity effect is that an older person is more likely to place a stronger emphasis on positive information and memories, rather than those which are associated with negative emotions (Westerhof et al., 2010, 04; Cappeliez et al., 2008; Dempsey et al., 2014; Westerhof & Bohlmeijer, 2014; Otake, 2015; Uzer & Gulgoz, 2015). Whilst older people are more biased towards positive personal memories (Cappeliez et al., 2008), those who are experiencing depression will tend towards memories which have a negative tonality (Hallford & Mellor, 2013; Cappeliez et al., 2007; Gonzalez et al., 2015; Otake, 2015). The positivity effect is described as people distancing themselves from negative memories, through adapting to selectively forget any past events which are not positive, possibly with the intention of creating an "idealised past" (Dempsey et al., 2014; Westerhof & Bohlmeijer, 2014). The positivity effect was demonstrated in a study conducted by Subramaniam et al. (2014), whereby the participants actively chose to avoid including details of traumatic events in the life story books they were creating. Whilst some potential users may have symptoms of depression, the positivity effect will help to ensure that positive memories are utilised in any self-guided reminiscence program. However, it will be important to ensure that those users who are experiencing symptoms of depression are supported to enter the memories which will make them feel better, not perpetuate the problem.

### 5.1.1 Study Research Questions

The purpose of this study is to assess the types of stimuli which are effective in evoking memories which leads to positive emotions for the PwD and their care-giver. This aim contains two main elements: eliciting memories, and evoking positive emotions. With this in mind, this study will have two research questions.

1. Which stimuli are effective for eliciting memories?
2. What types of memory are able to evoke positive emotions and feelings of happiness?

The results of these questions will be used to inform a reminiscence program, which can be implemented through the use of technology to be used within the community for PwDs and their care-givers, the aim of which is to improve happiness levels of the users. By ensuring knowledge of the types of memory which can stimulate positive memories, the program can be tailored to ensure positive emotions are supported whilst using the reminiscence intervention.

### 5.1.2 Hypotheses

In accordance with the positivistic philosophical perspective of this study, a set of hypotheses were developed and tested in order to answer the research questions. These hypotheses were aligned to each of the two research questions.

Research into involuntary memory retrieval suggests that often the recall of a memory can be traced back to a specific cue, with some being more effective than others (Mazzoni, Vannucci, & Batool, 2014). The first research question aims to investigate the types of stimuli which evoke memories, regardless of emotional valence. In this study, five stimuli are considered: music, photographs, videos, stories and newspapers. It is important to recognise that smell is also a key stimulus for evoking memories. However, with the aim of this research investigating the development of a reminiscence program which can be implemented using technology, smell would be an inappropriate stimulus to measure. Current technologies are unable to implement smell as an output modality, thus making the use of this memory cue within the developed reminiscence program infeasible.

Generally, memory cues are grouped into two categories: visual / auditory, and textual. Previous research suggests that visual / auditory cues are more effective than textual ones (Belcher & Kangas, 2013; Cohen-Mansfield, Marx, Thein, & Dakheel-Ali, 2010). However, in contrast, Mazzoni et al. (2014) found that whilst pictorial cues produced more vivid memories, more involuntary memories were evoked through the use of textual stimuli. This contradicts previous research which suggests that visual memories are a more effective stimulus than textual ones, and therefore, warrants further investigation.

The first hypothesis will aim to investigate whether visual / auditory cues are more effective at stimulating memories than textual ones. For this study, music, videos and photographs are considered to be visual / auditory cues, and stories and newspapers classified as textual stimuli.

*Hypothesis 1: Music, videos and photographs are more effective at evoking memories than stories and newspapers. [Research Question 1]*

For the second research question, it is proposed that memories of events can be split into three main categories: international or national, significant personal, and everyday. The events which are categorised within the international or national category are similar in concept to flashbulb memories.

Generally, research suggests that private flashbulb memories are perceived as more functional than those which are public (Demiray & Freund, 2015). In addition, Koppel and Berntsen (2016) found that the reminiscence bump, where memories from adolescence and early adulthood are predominantly remembered, is much more pronounced for private events than those which occurred in the public domain. This result is also found by Coluccia et al. (2010), whereby a greater amount of recall of personal memories than public events was observed. The implication of this is that memories which are of a personal nature, will be better remembered than those which are national events. When combined

with the knowledge that positive memories more likely to be rehearsed and ruminated on by older people (Allen et al., 2014), it could be suggested that private memories will evoke more positive emotions than those which are available within the public domain.

Much research suggests that events which have a personal value to them, or contribute to self-identity are more likely to evoke positive emotions and higher levels of engagement (Cohen-Mansfield, Marx, Dakheel-Ali, Regier, Thein, & Freedman, 2010; Cohen-Mansfield, Marx, Dakheel-Ali, Regier, & Thein, 2010; Cohen-Mansfield, Thein, et al., 2010). In addition, it has been found that memories which had a self-identity feature were effective at reducing agitation in PwDs (Cohen-Mansfield, Marx, Dakheel-Ali, Regier, Thein, & Freedman, 2010). In fact, Cohen-Mansfield, Marx, Dakheel-Ali, Regier, and Thein (2010) found that personalised stimuli relating to self-identity were effective regardless of the cognitive abilities of the participants. In a study conducted by Cohen-Mansfield, Marx, Thein, and Dakheel-Ali (2010), it was found that individualised interventions resulted in greater feelings of pleasure than those which were not personalised. This research all suggests that memories which are personal to the reminiscer will lead to greater positive emotions.

Therefore, the following three hypotheses are to be tested in relation to the second research question, aiming to investigate the type of memory which evokes positive emotions. Both hypothesis two and three will aim to confirm previous research that personalised events will produce more positive emotion than those which are non-personalised. The addition of hypothesis four will assess the type of personalised memory which is of benefit to older adults, whether it is everyday events which are representative of real-world activities or rites of passage which produce greater positive emotions.

*Hypothesis 2: Big personal events evoke more positive emotions than big events which occur on an international or national level. [Research Question 2]*

*Hypothesis 3: Everyday events evoke more positive emotions than big events which occur on an international or national level. [Research Question 2]*

*Hypothesis 4: Big personal events evoke more positive emotions than everyday events. [Research Question 2]*

In addition to investigating whether personalised events lead to more positive emotions, this research will also aim to assess whether stimuli which can be seen as private will be more effective at evoking memories than those which are made available through the public domain. This will also build on the research discussed above, and extend it to consider the stimulus too. Therefore, a fifth hypothesis will be tested, which will contribute towards answering the first research question.

*Hypothesis 5: Stimuli which are available in the public domain are less effective at evoking memories than those which are private. [Research Question 1]*

These five hypotheses will be tested and the outcomes discussed during the course of this chapter, with

the aim of answering both research questions. Subsequently, the results of the study will be implemented within a reminiscence program which is developed to be implemented on a tablet device.

### **5.1.3 Chapter Structure**

This chapter will describe the process carried out and the results of this study. Firstly, it will describe the methods utilised in order to collect and analyse the required data to facilitate answering the research questions. The findings for each hypothesis will be discussed and placed both within the context of the research questions, and the wider research body. Finally, this chapter will discuss how these findings will impact the development of a positive reminiscence program which can be facilitated using recent advances in technology.

## **5.2 Method**

The following section will discuss the method used to collect and analyse the data required to answer the research questions of the study.

### **5.2.1 Materials and Measures**

This study utilised a questionnaire to collect data relating to stimuli for evoking positive memories. The questionnaire was developed by the researcher with the aim of answering the research questions. It was split into three distinct sections: demographic data, stimuli for evoking memories, and memories that evoke positive emotions (see appendix B.3 for the questionnaire used).

The demographic section collected data relating to the gender, age, geographic location, and pre-existing mental health conditions. During this study, none of the demographical data was utilised for analysis, other than to isolate people who are over the age of 50 (see section 5.2.3 for an explanation). However, future plans involve further analysis to investigate whether age, gender, geographic location, and pre-existing mental health conditions have an effect on types of stimuli to evoke positive memories within the general population.

The questionnaire section which aims to assess the types of memory which evoke positive emotions was split into three subsections: international and national event, big personal events, and everyday events.

#### **5.2.1.1 Initial Exploratory Research**

In order to develop the list of personal memories (both significant and everyday events), an initial study was conducted with 5 care-givers of PwDs and 12 members of staff in the School of Computing at

the University of Portsmouth. Participants were asked to identify five memories which make them feel happy, and five which evoke feelings of sadness. Results of this analysis informed the choice of big personal memories and everyday events (see appendix B.1, for more detailed results).

#### **5.2.1.2 Questionnaire Pilot**

Upon development of the full questionnaire, a pilot study was carried out involving care-givers of PwDs (full results of the pilot study are reported in appendix B.2). In total, 11 people completed the pilot questionnaire. This led to a number of adjustments, particularly to the international / national events section, which included a couple of events which did not evoke any positive or negative emotions. These events were all related to the release of fictional works. Therefore, these events were replaced with non-fictional significant memory prompts.

Subsequently, the final questionnaire was released to potential respondents. A copy of the released questionnaire is included within the appendix (see section B.3). In addition, a full rationale for the questionnaire can be found in appendix B.4.

### **5.2.2 Procedure**

The questionnaire was disseminated in two formats: online, and paper-based. Both versions of the questionnaire were identical, only the transmission medium changed. The use of both media aimed to ensure a wide range of possible participants. Additionally, the use of a paper-based version recognised that not all older people had access to the online submission form. Thus, empowering them to actively contribute to the research outcomes.

From an ethical standpoint, this research has been reviewed by the Faculty of Technology REC. All participants were provided with information prior to completion of the questionnaire. The act of completing and submitting the questionnaire was considered to be informed consent. Additionally, it was assumed that if a participant was capable of obtaining, completing, and submitting the questionnaire, they had the required capacity to consent to their inclusion. Participants were provided with the opportunity to withdraw from the study at any time during the completion of the questionnaire and up to a week after submission.

### **5.2.3 Participants**

Initially, it was intended for the responses of people living with dementia to be compared against those who do not have the condition. However, due to the limited number of responses from people living with dementia ( $N = 5$ ), it was decided not to carry out this analysis. In the UK, 99.6% of people living with dementia are over the age of 50 (Prince et al., 2014). In addition, the majority of people

living with dementia in the community are supported by their wife, husband or partner (Alzheimer's Society, 2013). In addition, the outcome of this research project does not aim to solely focus on those who are living with dementia. It aims to investigate the acceptance of an application which has been designed to be utilised by both PwDs and their care-givers. Therefore, the findings of this study need to take into account both user groups, the PwD and their care-giver. Therefore, for these reasons, this study will only consider the responses of people who are over the age of 50. Whilst data was collected for people over the age of 18, from this point forward any participants under the age of 50 will be disregarded.

In total, 212 people completed the questionnaire to a satisfactory level of completion to warrant inclusion within the study. Of these 212 people, 57 respondents met the inclusion criteria of being over the age of 50. From this point onwards, only people over the age of 50 will be considered. The mean age of the participants included within the study was 66.07 years old ( $SD = 12.72$ ), with an age range between 50 and 97 years. Of the total participants 40.4% were male and 59.6% were female, equating to 23 and 34 participants respectively. This male to female ratio is in line with the national average, but not exactly representative, where men represent 46.9% of the population over the age of 50 (Office of National Statistics, 2012).

#### 5.2.4 Data Analysis

Throughout this thesis, the IBM SPSS Statistics package has been used to analyse quantitative data. In addition, a significance level of 0.05 will be utilised to test whether the relevant null hypothesis can be accepted or rejected.

Before any data analysis can commence, a knowledge of the data distribution is required. If the data can be considered to be normal, parametric testing can be conducted. In order to evaluate the normality of the distribution, the Shapiro-Wilk test was carried out. The null hypothesis for Shapiro-Wilk is that the data is normally distributed. Therefore, when the significance level for the test is above 0.05, the null hypothesis can be rejected and the data is considered to be non-normal.

The results for the distribution testing show the majority of the variables cannot be considered to have a normal distribution (see appendix B.5 for full results). This information allows a decision to be made as to whether parametric or non-parametric tests would be most appropriate to use for the hypothesis testing. For data analysis to utilise the improved power of parametric tests, normalised data is required. Despite some variables being normal in nature, non-parametric tests will be utilised as most variables are not normally distributed. The data which is classified as normal can be included in analysis using non-parametric testing.

Due to the nature of the data collected, the Wilcoxon Signed Rank Test, which is a non-parametric comparison method, will be used to evaluate the significance of any differences between the groups.

Whilst some variables could be considered as normally distributed, as they will be compared with variables which are not normally distributed, non-parametric tests will be used.

## 5.3 Results

Prior to assessing the statistical significances based on the hypotheses, it was decided to rank the stimuli and memory types based on their mean value. For the stimuli, a higher mean relates to greater effectiveness at evoking memories. With regard to the second category, a higher number signifies more positive emotions associated with the memory type, whereas a lower number relates to greater feelings of sadness.

Table 5.1: Stimuli ranked based on mean value

Rank	Stimuli	Mean	Standard Deviation	Median
1	Photographs	3.8351	0.7989	4.0000
2	Stories	3.7792	1.0833	4.0000
3	Music	3.6471	0.8615	3.6667
4	Videos	3.3183	1.1312	3.5000
5	Newspapers	2.8985	1.0105	3.0000

From table 5.1 it can be seen that the most effective stimuli to evoke memories for people over the age of 50 is photographs. In contrast to what was anticipated, stories is ranked as the second most effective stimuli for evoking memories. Previous literature has suggested that music is a very effective stimulus for evoking memories, however, this suggests that it is not as effective as prompts which utilise photographs and the telling of stories.

Table 5.2: Memory type ranked based on mean value

Rank	Memory Type	Mean	Standard Deviation	Median
1	Big Personal Events	3.4386	0.3754	3.4808
2	Everyday Events	3.4178	0.3785	3.3452
3	National / International Events	2.9971	0.2885	3.0000

The above table demonstrates that big personal events are associated with greater positive emotions. Whilst the everyday memories are second, the difference between the mean values are small, suggesting they may have similar effects on participants with regards to happiness and positive emotions. However,

this difference could be a result of the study including a small number of participants.

### 5.3.1 Hypothesis 1

The first hypothesis suggested that stimuli using music, video or photographs are more effective at evoking memories than those which involve stories and newspapers. In order to assess this hypothesis, the mean value for music, videos and photographs combined, and the mean for stories and newspapers were found. Table 5.3 shows the results of this calculation.

Table 5.3: Stimuli grouped based on hypothesis 1

Stimuli	Mean	Standard Deviation	Median
Music, Videos and Photographs	3.6708	0.76432	3.8125
Stories and Newspapers	3.3488	0.93890	3.3750

The difference between the two groups can be considered statistically significant ( $p = 0.001$ ), leading to the conclusion that photographs, music and videos are more effective at evoking memories than stories and newspaper stimuli. However, based on the rankings shown in table 5.1, stories were the second most effective stimuli for evoking memories. This implies that newspapers (which was the least effective) had an impact on the result. Therefore, further comparisons were carried out to assess this theory. When comparing the grouped music, videos and photographs variable with the stories the result was non-significant ( $p = 0.181$ ). However, when comparing the grouped variable with newspapers, the difference was significant ( $p < 0.0001$ ). This suggests that the newspaper variable skews the results when grouped with the stories stimuli.

### 5.3.2 Hypothesis 2

The difference between big personal events and those which are national or international is the subject of the second hypothesis. It is thought that the big personal memories will result in increased feelings of happiness than events which are considered to be on the national or international stage. In order to obtain a value for international and national memories, the results for each of the events in question eight were averaged (see questionnaire in appendix B.3). Additionally, the events listed in question twelve of the questionnaire were averaged to produce an average value for the level of happiness produced by big personal memories.

Table 5.4: Memory types analysed in hypothesis 2

Stimuli	Mean	Standard	Median
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		<b>Deviation</b>	
International and National Events	2.9971	0.28845	3.0000
Big Personal Events	3.4386	0.37536	3.4808

Table 5.4 demonstrates the results of the combination of the separate variable for each category. The difference between the international or national memories and those which are big personal events is statistically significant ( $p < 0.0001$ ). Therefore, it can be assumed that big personal events evoke more positive emotions than those which were experienced on a national or international level.

### 5.3.3 Hypothesis 3

Hypothesis three aimed to evaluate the differences between everyday events and memories of events which occurred on an international or national stage. In order to evaluate this, two variables were generated based on the results of the questionnaire. The variables included within question thirteen of the questionnaire distributed to participants (see appendix B.3 for a full list) were averaged to produce an average value for the everyday events. Similarly, the events listed in question eight, were averaged to produce a result for the international and national variable.

Table 5.5: Memory types analysed in hypothesis 3

<b>Stimuli</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Median</b>
International and National Events	2.9971	0.28845	3.0000
Everyday Events	3.4178	0.37847	3.3452

The results shown in the above table demonstrate that everyday events elicited more positive emotions than those created by the international or national memories. This difference was found to be statistically significant ( $p < 0.0001$ ). This, therefore, proves the hypothesis that everyday events will produce more positive emotions than those which occur on an international or national stage.

### 5.3.4 Hypothesis 4

The subject of the fourth hypothesis related to the differences between big personal events and those which occur everyday. A value for big personal events was obtain by averaging the results of each variable within question twelve of the developed questionnaire (see appendix B.3). Additionally, the variables included within question thirteen were combined to produce a value for everyday events. Table 5.6 show the results of these calculations.

Table 5.6: Memory types analysed in hypothesis 4

Stimuli	Mean	Standard Deviation	Median
Big Personal Events	3.4386	0.37536	3.4808
Everyday Events	3.4178	0.37847	3.3452

From table 5.6 it can be seen that big personal events produces marginally improved positive emotions than everyday events. However, upon completion of the Wilcoxon Signed Rank Test it can be seen that the difference between the two variables is not statistically significant ( $p = 0.572$ ). Therefore, the hypothesis that big personal events will produce more positive emotions than everyday events cannot be supported. This could be a direct result of the relatively small sample size. Future research involving a larger sample of people over the age of 50 could produce a result which is statistically significant. Additionally, earlier in this study it was established that personal stimuli is more effective at evoking memories than those which are available in the public domain. This statistically non-significant result could be related to this finding, in that personal memories produce positive emotions regardless of whether they are big or small. This is an area of research which should be investigated in the future.

### 5.3.5 Hypothesis 5

Hypothesis five stated that stimuli which are available in the public domain are less effective at evoking memories than those which are private. To evaluate this hypothesis, the following stimuli were considered to be available in the public domain: music from my early years, music from my teenage years, recent music, theme tunes, favourite music of friends / family, scenery photos, videos of national and international events, newspaper clippings related to me, newspaper clippings of local events, newspaper clippings of national / international events, and Newspaper clippings of odd / unexpected events. The private stimuli included: photos of myself, photos of my family, photos of my friends, holiday photos, school photos, videos of myself, videos of my family, videos of my friends, stories of funny things, personal achievement stories, dramatic stories, and stories I have taken part in. Table 5.7 shows the results of the calculations for these two groupings.

Table 5.7: Stimuli grouped based on hypothesis 5

Stimuli	Mean	Standard Deviation	Median
Public Stimuli	3.2877	0.81821	3.2500
Private Stimuli	3.8597	0.88253	4.0833

The difference between the two groupings of stimuli was statistically significant ( $p < 0.0001$ ). This suggests that private stimuli are more effective at evoking memories than those which are available within the public. When inspecting the contents of each grouping, this could be anticipated as the private stimuli contains the photograph and story stimuli. Additionally, the public group contains the newspaper stimuli which is significantly less effective than all the other types of stimulus, which has the potential to skew the results.

## 5.4 Discussion

The following sub-sections will discuss the results obtained through the hypothesis testing conducted within the previous section. Each research question will be considered separately, with the results discussed in relation to the existing literature and their place within this thesis.

### 5.4.1 Research Question 1

The first research question for this study aimed to investigate the most appropriate type of stimulus to evoke memories within the over 50s. The results of hypotheses one and five will be discussed within this section.

When comparing visual / auditory and textual cues, there was no consensus with regards to the most effective stimulus. Research conducted by Mazzoni et al. (2014) found that textual cues were more effective at evoking memories than visual aids. However, in contrast, Berntsen (1996) found that visual and auditory cues were more effective than textual ones. This finding was also observed by Roebers and Elischberger (2002, cited by (Mazzoni et al., 2014)). When newspaper stimuli are included within the comparison between visual / auditory, this research would appear to confirm the results of Berntsen (1996). However, upon observation of the rankings, it is clear that the newspaper stimuli are biasing the results of the textual cues, especially as stories are ranked as the second most effective stimulus. Controlling this factor, leads to an inconclusive result, whereby it cannot be demonstrated that textual or visual / auditory cues are more effective at evoking memories.

The results of this study suggest the most effective stimuli for evoking memories in the over 50 age group are: photographs, stories and music. Therefore, the developed program of reminiscence will provide support for these three types of stimulus. However, it is entirely possible that future iterations of the reminiscence program could include a provision to support older people to enter both video and newspaper stimuli. Indeed, the current program could already support newspapers, through the use of either the story or photograph stimuli.

### 5.4.2 Research Question 2

The second research question in this study aimed to assess the types of memory which needed to be included within a reminiscence program in order to evoke positive emotions in the person reminiscing. Through answering this question, an appreciation of whether memories should be personalised to the individual was gained. To evaluate the answer to this research question, the results from hypotheses 2, 3, and 4 are discussed.

The findings of the hypotheses related to research question 2 appear to support existing literature, in that personalised memories evoke greater levels of positive emotion than those events which occur on a national scale. This result seems aligned with previous research which suggests greater levels of engagement and positive emotions when the memories included are personalised to the participant (Cohen-Mansfield, Marx, Dakheel-Ali, Regier, Thein, & Freedman, 2010; Cohen-Mansfield, Marx, Dakheel-Ali, Regier, & Thein, 2010; Cohen-Mansfield, Thein, et al., 2010; Cohen-Mansfield, Marx, Thein, & Dakheel-Ali, 2010).

It is important to consider the person when deciding on the optimal type of memory for them. A person's characteristics, cognitive abilities, and preferences should always be considered when choosing the most appropriate memory or event (Cohen-Mansfield, Marx, Dakheel-Ali, Regier, & Thein, 2010). Therefore, through allowing the participants to input their own memories in the reminiscence program, a greater level of individualisation will occur. In addition, as demonstrated in this study, personalised memories have a greater emotional impact on older adults than those which are not tailored to the individual.

The results of this research question, and those of hypothesis five, demonstrate that the reminiscence program should only include personalised memories. Therefore, rather than providing the users with generic memories of significant events, they should be encouraged to enter their own recollections. This should lead to feelings of positive emotions rather than the negative ones which could be associated with the non-personalised memories. In addition, research suggests that PwDs will be more engaged with personalised cues than generic stimuli, which could then lead to stronger positive emotions.

## 5.5 Conclusion

The study discussed within this chapter aimed to develop the theory for use within the at-home reminiscence program. Two main findings were established. Firstly, the optimal types of stimuli to evoke memories for older people are photographs, stories, and music. Secondly, the use of personalised memories will generate more positive emotions than those which are generic in nature and refer to national or international events. The implications for this research is clear. In order to successfully evoke positive

emotions for reminiscence, the developed program should incorporate personalised memories, which utilise photographs, stories, and music as the stimulus.

Despite significant results, this study does have limitations. Firstly, the sample size utilised is small ( $N = 57$ ), therefore, generalisation to the population is challenging. Secondly, due to the small number of respondents who were living with dementia was too small to allow for analysis. Hence, there was no analysis as to whether the stimuli and memory types were different for those living with the condition. Therefore, future research should aim to increase the number of respondents to the questionnaire, ensuring a larger proportion are PwDs.

This chapter has identified the types of memory which should be most effective at evoking positive reminiscence in people over the age of 50. These results will be used to inform the types of memory which are available to add into the technology-supported reminiscence program. The next chapter in this thesis will aim to investigate the technology interaction requirements of people living with dementia, in order to implement a reminiscence program based on the theory discussed in this study using an application whose interaction has been designed to ensure it does not exclude people living with dementia.

## CHAPTER

# 6

# DESIGNING DEMENTIA FRIENDLY INTERFACES

## 6.1 Introduction

In order to ensure that the technology-supported intervention based on positive reminiscence therapy is usable for PwDs, their special needs must be considered throughout the development process. This study will, therefore, aim to develop a framework which can be used to inform the early stages of the interface design process. It is not anticipated that the results of this study will eliminate the need to carry out user-centred design techniques, instead, it will aim to complement the participatory design process. Additionally, it will avoid exposing PwDs too early in the design process, as an incomplete system may affect the acceptance of the technology (Karlsson et al., 2011).

As the focus of this study is to investigate the needs of PwDs when interacting with technology to inform a design framework, the implications associated with the symptoms of the condition need to be considered. In addition to the symptoms of dementia, people living with the condition will also be affected by the natural ageing process. Therefore, this study will not only need to consider how the symptoms of dementia can affect one's interaction with technology, but also how the changes associated with ageing can have an impact too.

As people grow older, the effects of the ageing process become less defined within the demographic

(Wallace, Graham, & Saraceno, 2013; Greengard, 2009; Miller, Gagnon, Talbot, & Messier, 2013; Ancient & Good, 2013). To complicate matters further, PwDs will each experience the condition differently with varying rates of deterioration, leading to a wide diversity of needs between the potential users of the system. This makes designing a “one size fits all” interface difficult to achieve, as enhancements which are appropriate for one user may deskill another.

It is widely known that older people as a demographic have some of the lowest levels of technology adoption (Vastenburg, Visser, Vermaas, & Keyson, 2008; Heart & Kalderon, 2013). However, contrary to popular belief, not all older people are against the use of technology (van Veldhoven, Vastenburg, & Keyson, 2008). There is in fact research which suggests the opposite: older people can (and do) show an interest in using technology (Lin, Neafsey, & Strickler, 2009). In addition to the traditional design considerations of accessibility, usability and user experience, technology developers need to consider factors which influence their target audience’s acceptance of technology.

Whilst many people have investigated the needs of older people when it comes to interaction with technology, few studies have considered the special needs associated with the symptoms of dementia. In addition, there are many studies which make suggestions about individual aspects of ageing, but none which synthesise multiple studies together to generate a framework which supports interface designers when developing interfaces for older people, with an emphasis on those who are living with dementia.

The purpose of this study is to develop a set of guidelines which will allow for the development of interfaces which are dementia friendly. This will contribute to both this research project and the interface design as a whole. For this project, it will allow the reminiscence program to be implemented using technology to be developed in a way which will empower the users to be able to guide their own interaction with the system. In addition, it will allow everyday technologies, with an emphasis on assistive devices, be developed a way which promotes ease of use and acceptance by people living with the condition.

This study has the potential to have a far reaching impact for PwDs when it comes to interacting with technology. By providing interface designers with guidelines which have the potential to make computing dementia-friendly, people living with the condition may be able to interact with an increasingly online world for longer. This may, in turn, increase independence and provide additional activities for people living with dementia to engage in. In addition, by considering the natural ageing process throughout this study, and full integrating its implications in the guidelines, older people without any cognitive impairments may find technology easier to interact with.

This chapter will discuss the research conducted in order to develop a set of guidelines for designing interfaces for PwDs. Firstly, the literature searching and evaluation methods will be discussed. Subsequently, the results of the searches and content analysis carried out will be discussed. This study will

aim to synthesise the literature, which will also be discussed in this chapter. Finally, the conclusion will reiterate the research questions previously stipulated and present the guidelines which have been developed as a result of the research featured here.

## 6.2 Method

The study included in this chapter follows a secondary research approach, involving a systematic search of the relevant literature relating to interface design and technology acceptance. Once the relevant literature had been found, the articles were subjected to a thematic content analysis and the findings synthesised. Based on this synthesis, ten guidelines of interface design were developed. Between September and November 2013 a literature search using the Discovery Service tool provided by the University of Portsmouth was conducted. This tool allowed the search of multiple library resources, including ScienceDirect, IEEE Xplore and the ACM Digital Library, to be explored simultaneously (for a full database listing visit: <http://www.port.ac.uk/library/infores/discovery/>). Boolean logic was used to combine the keywords listed in table 6.1. This allowed the search results to be narrowed and ensured each of the title, abstract and subject terms were investigated for the inclusion of all keyword combinations. The Discovery search engine provides the functionality to search within the full text of a publication. However, in order to minimise the possible number of redundant results, it was decided not to utilise this functionality. All the searches were limited to articles which have been published between January 2008 and December 2013. This ensured that only recent articles were obtained as part of the searching algorithm so as to only consider the most up-to-date knowledge and to obtain recommendations for the latest advances in technology, such as tablet computers.

Table 6.1: Keywords Used During the Systematic Search Procedure

dementia	old	elder*
aged	aging	ageing
interact*	technolog*	comput*
“user experience”	experience	accessib*
usab*	“design consideration”	“design considerations”
impair*	mobile	“human factor”
“human factors”	hci	“interface design”
tablet	iPad	ubiquitous
pervasive	interface	“design implication”
“design implications”	accept*	“user acceptance”
personal*	ergonom*	“silver surfer”
“silver surfers”	adopt*	



After the initial searches had been completed, the following inclusion criteria were applied based upon the publication abstract:

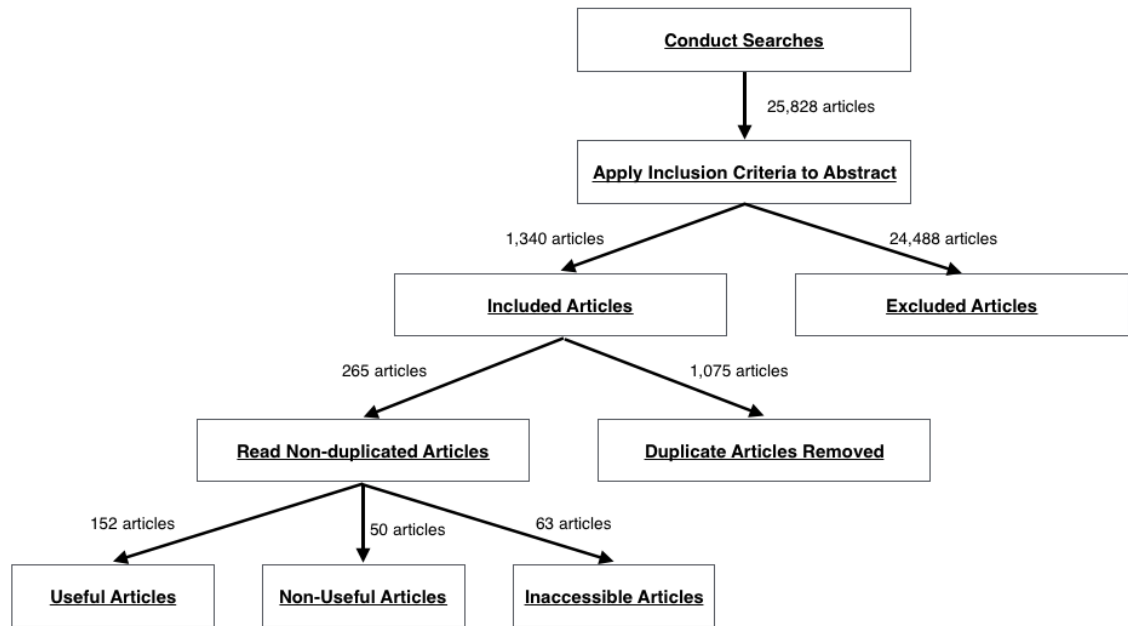
- Publications written in English
- Articles published in Academic Journals, Conference Proceedings and Books
- Publications where the focus is ensuring interfaces are suitable for older people and those living with dementia (including accessibility, usability, user experience and user acceptance theory)

The above inclusion criteria only include articles which focus on the interface design needs of the elderly and PwDs. However, additional articles which focus on other topics but make suggestions about interface design were not included in this analysis, but have been reserved for future research. In addition, duplicate articles were removed from the analysis, reducing the number of articles to be read. For each publication which was deemed to be useful towards answering the research question, the main theme was coded using one of the following: accessibility, usability, user experience and user acceptance. The articles were also read to find sections of the text which were relevant to the challenges faced by older people and people living with dementia when interacting with technology. These sections were then coded using the four main topics covered by this study: accessibility, usability, user experience and user acceptance. Subsequent codings were added to the sections of text using a grounded approach.

## 6.3 Results

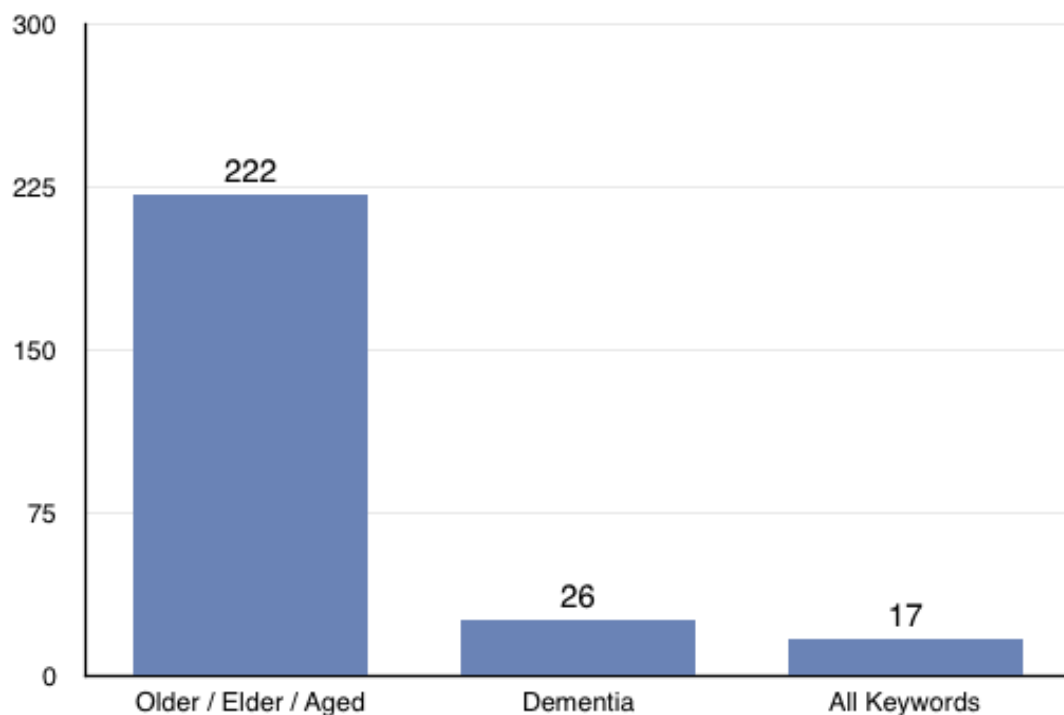
In total, 150 searches were conducted (see appendix C.1 for a list of results from each search), resulting in 25,828 possible articles. The inclusion criteria were applied to the abstract of each article, then duplicated publications were removed. This lead to a total of 265 articles to be read in their entirety. The flow chart in figure 6.1 shows the quantities of articles which were removed at each stage.

Figure 6.1: Literature searching strategy diagram



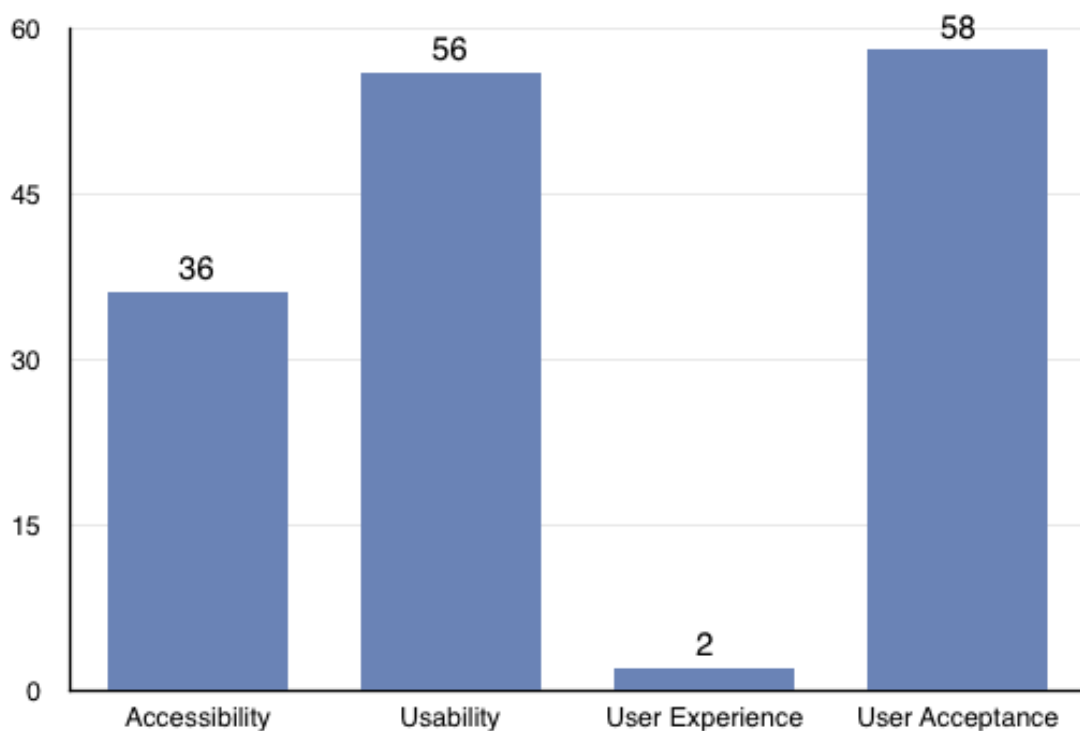
All the searches conducted either included “dementia” or a keyword relating to old age (“old”, “elder\*”, “aged”, “aging”, “ageing”). From figure 6.2, it is easy to see that in the years 2008 to 2013, there was minimal research conducted into the interface needs and requirements of PwDs. Therefore, this is an area of research which must be investigated in the future, especially as the number of people who will be living with the condition is set to rise dramatically.

Figure 6.2: Chart showing number of articles using main keywords



Once the articles had been read, they were coded into one of four groups, based on the standard user interaction design paradigm: accessibility, usability, user experience, and user acceptance. The graph in figure 6.3 shows that usability and user acceptance have been key areas of interest during the period 2008 to 2013. However, there has been a serious lack of research into the experience a user has when interacting with technology. The user experience can have a significant impact on their acceptance of a device, therefore, it is important that this lack of research is rectified in the near future.

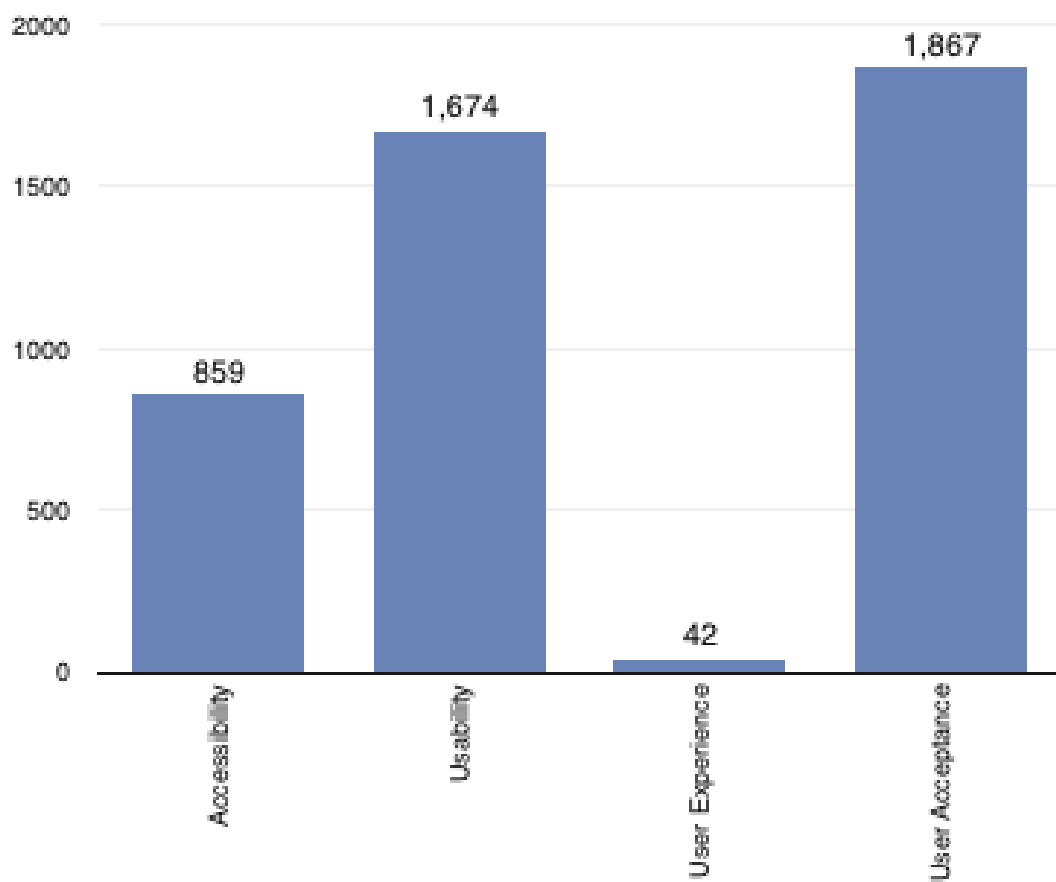
Figure 6.3: Chart showing number of articles coded using the main interface design principles



Whilst reading the articles, relevant sections of text were collated in preparation of a content analysis being conducted. In total, 4339 quotes were collected (an average of 28.55 quotes per article). They were initially coded into a couple of categories. Firstly, the user interaction design element was considered (accessibility, usability, user experience, and user acceptance). Secondly, grounded subcodes were developed based on the content of the quote. In total, there were two levels of subcodes, however, this chapter will only discuss the first layer. Finally, their context was considered (i.e. did they discuss background information, problems, or recommendations).

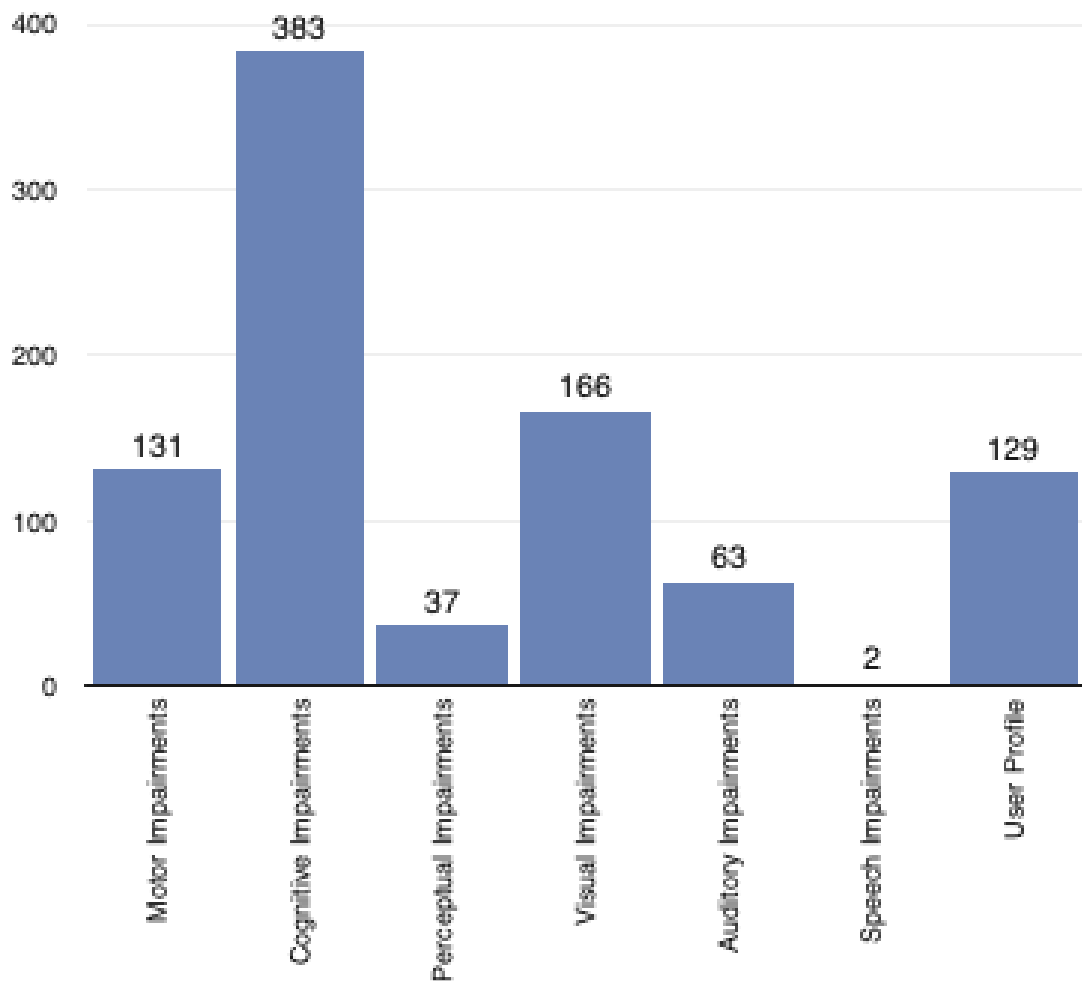
The graph in figure 6.4 demonstrates the coding of the quotes based on the first category in which they were coded, the user interaction design elements. It can be seen that the individual quotes follow a similar pattern to the articles as a whole, with user acceptance being the most discussed topic, and user experience the least.

Figure 6.4: Chart showing number of quotes coded using the main interface design principles



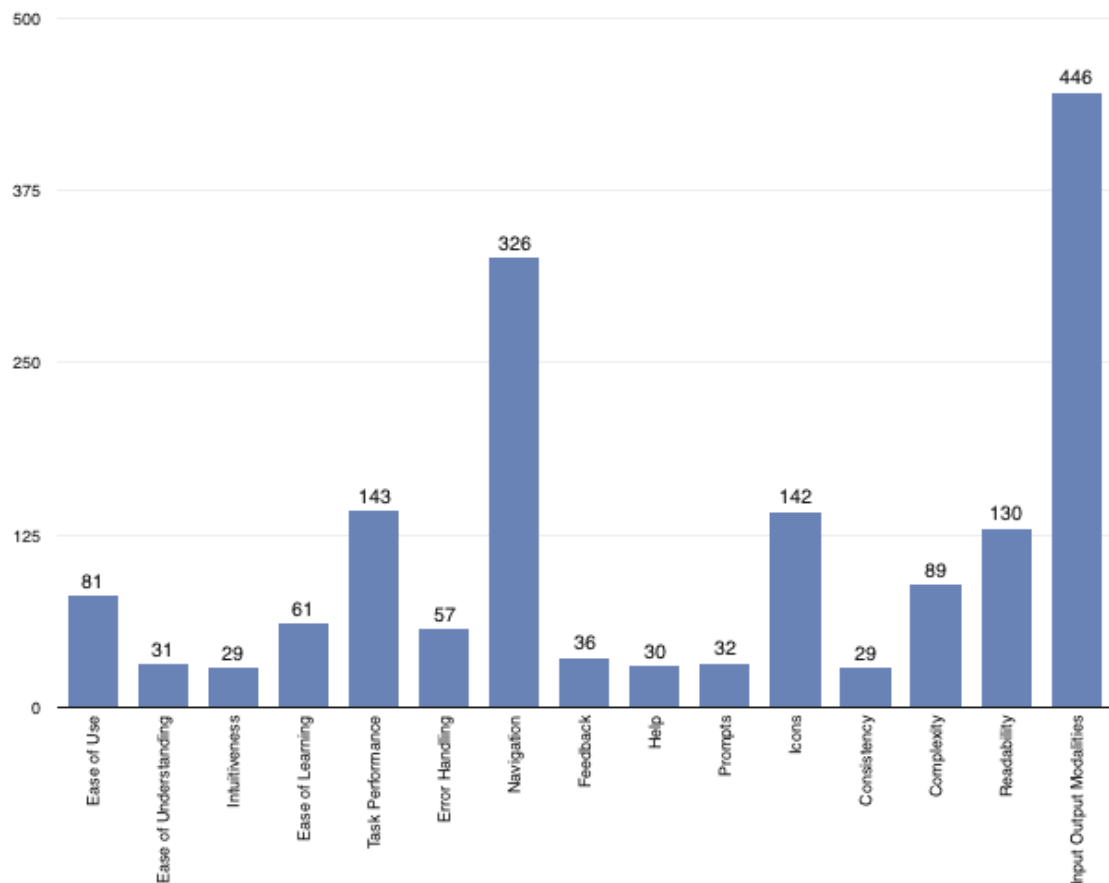
As shown in figure 6.5, the accessibility codes were also broken down into the following subcodes: motor impairments, cognitive impairments, perceptual impairments, visual impairments, auditory impairments, speech impairments, and user profile. The user profile code included information relating to the user group, including generic characteristics of the demographic. The majority of the codes related to cognitive impairments. This could have been anticipated as this type of impairment is synonymous with a diagnosis of dementia. Motor impairments and visual impairments also have a high proportion of quotes relating to them. The combination of these three impairments make the most important accessibility issues which need to be considered when designing user interaction.

Figure 6.5: Chart showing accessibility subcodes



The usability quotes were split into a number of subgroups. As shown on the graph in figure 6.6, it can be seen that Input Output Modalities and navigation are the two most researched areas of usability for older people. This could be expected as considering the input and output modalities will allow the users to interact with the system, and navigation is how the older person makes their way around the system. Without considering these two factors, it could be impossible for the older adults to use the technology, reducing its use, and making its development an endeavour which is not worthwhile.

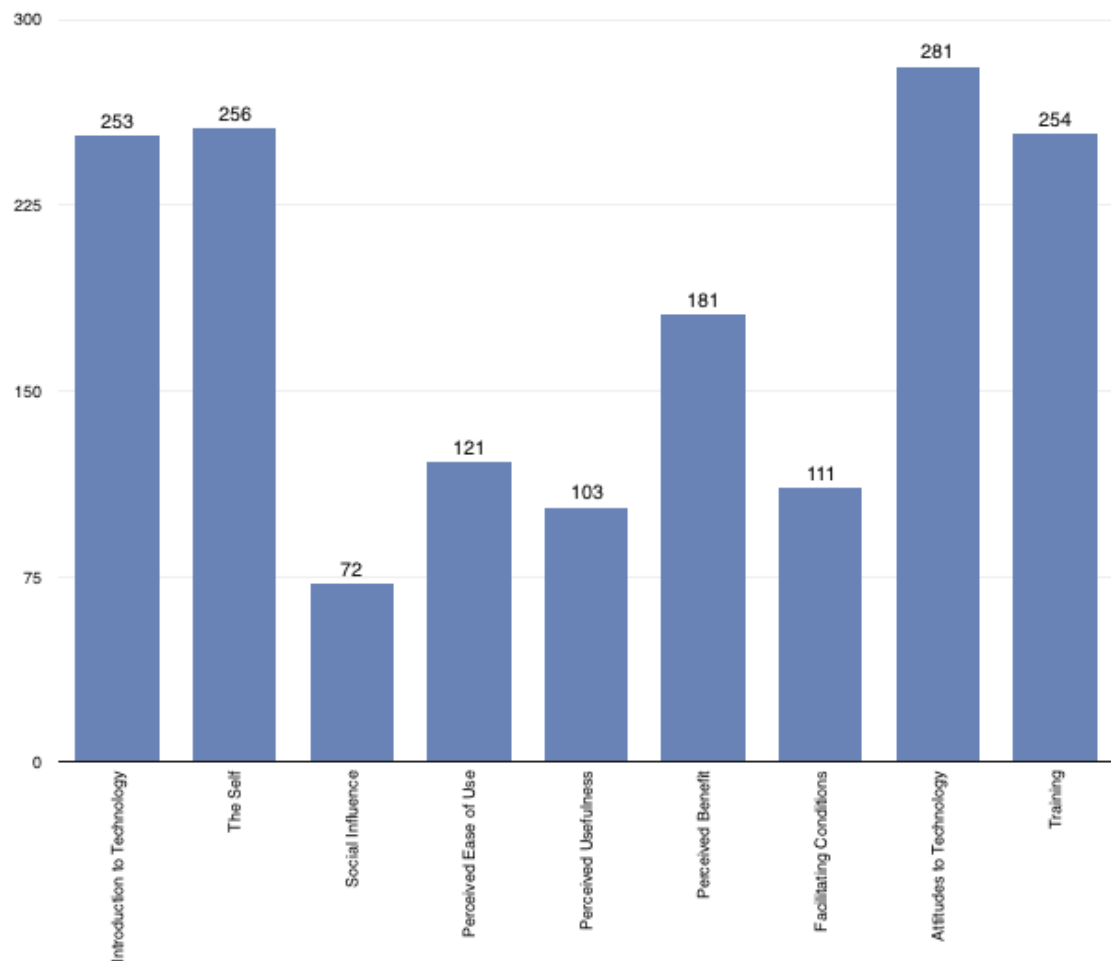
Figure 6.6: Chart showing usability subcodes



The low quantity of user experience quotes lead to only one subcoding being generated, this was labelled colour. Therefore, no graph or further analysis, other than the literature synthesis, has been conducted on these quotes. Further research should be embarked on in this area in order to improve our understanding of how the experience of using an interface can be improved for older people and those living with dementia.

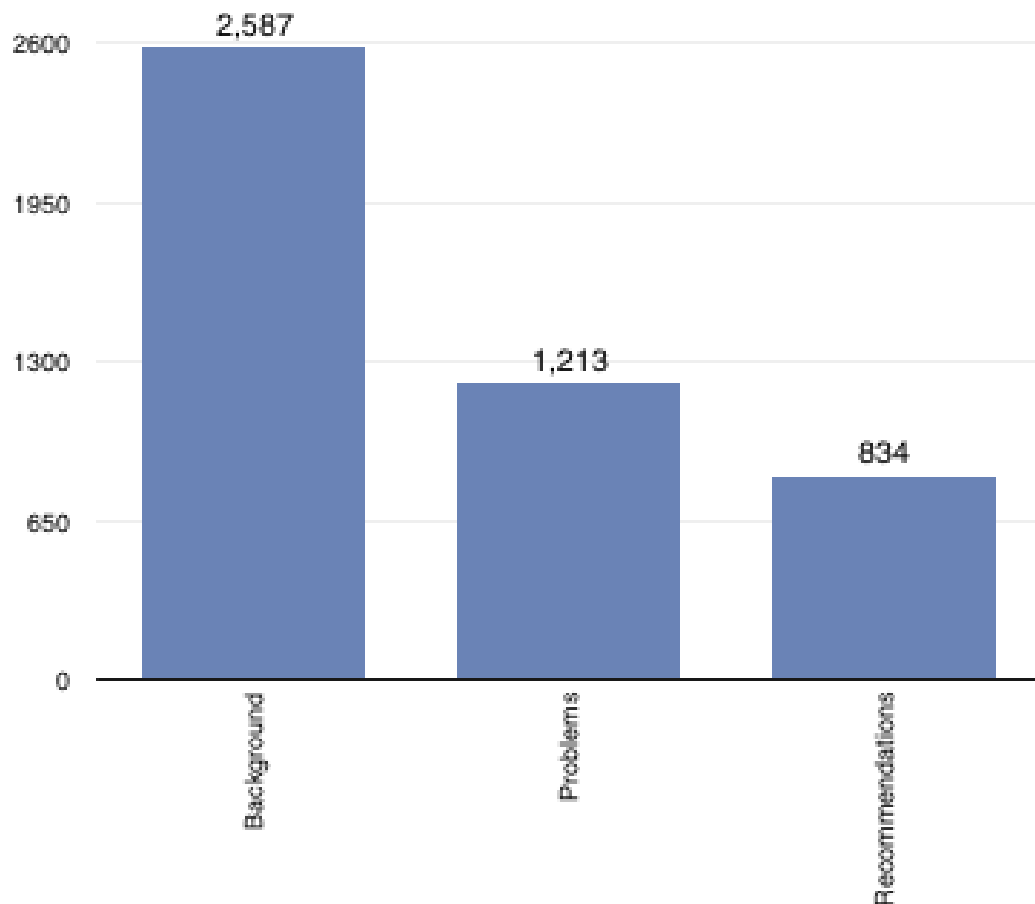
Figure 6.7 demonstrates the subcodes for the user acceptance quotes. These codes are distributed more evenly across the different groupings. However, it is clear to see that four factors arise as those which have been important to research: introduction to technology, the self (which includes confidence, self-efficacy, self-image and home environment), attitudes towards technology, and training. Based on the research conducted each of these factors should have an impact on whether an older person is willing to accept new technologies.

Figure 6.7: Chart showing user acceptance subcodes



Finally, each quote assessed as to whether it discussed background information about the topic, a problem, or a recommendation. It can be clearly seen from the graph that the majority of quotes related to background material on the topics covered in this study. In addition, the graph shows that problems with interaction design are often highlighted without recommending a potential solution. It is clear to see from this graph that more research needs to be conducted to assess the possible recommendations to counteract the problems which have been previously established.

Figure 6.8: Chart showing quote types



In the next section, the literature found as part of the searching strategy will be synthesised, to attempt to draw out some guidelines which should be implemented when designing interfaces for older people.

## 6.4 Literature Synthesis

The results section has demonstrated the relative lack of research relating to designing interfaces for PwDs. It has, however, shown that there are many issues which need to be considered when developing technological interventions for older people. This remains relevant to the current study, as the majority of PwDs are over the age of 65 (Alzheimer's Society, 2012). Therefore, not only will they experience the symptoms associated with the condition, they will also undergo the ageing process.

The following section will focus on the requirements for interaction design. Where possible, the discussion will demonstrate how the challenges will directly impact PwDs. However, as seen in the results section, the amount of research relating to interface design principles for PwDs is limited. The discus-



sion section is split into the four areas previously shown in the results section. Firstly, accessibility will be considered. Subsequently, usability and user experience (UX) will be discussed. Finally, strategies to improve user acceptance will be demonstrated.

### 6.4.1 Accessibility

When designing interfaces, it is important to consider the changes which will affect people as they age (Hertzum & Hornbæk, 2010). Taylor et al. (2014) suggest that catering for older people when interacting with technology is more relevant than considering the broader population. As a person ages, their physical and mental condition will deteriorate (Chou, Lai, & Liu, 2012; Tenneti, Johnson, Goldenberg, Parker, & Huppert, 2012; Hollinworth & Hwang, 2010; Langdon & Thimbleby, 2010; Shahid, Mubin, & Al Mahmud, 2009; Calero Valdez, Ziefle, Horstmann, Herding, & Schroeder, 2009; Y.-C. Hwang, 2011; Boontarig, Chutimaskul, Chongsuphajaisiddhi, & Papasratorn, 2012). This decline needs to be considered when implementing an interface which will be used by an older person as interaction can be negatively affected (Chou et al., 2012; Hertzum & Hornbæk, 2010; Granata et al., 2013; Biswas, Robinson, & Langdon, 2011; Wallace et al., 2013; Wandke et al., 2012). However, these challenges are often not considered by interface designers (Or & Tao, 2012; Charness & Boot, 2009). The abilities which change are often broadly categories into four groups of impairments: motor, cognitive, visual, and auditory. Whilst Heart and Kalderon (2013) conclude that issues relating to accessibility are no longer barriers to use of technology, there remains a need to consider accessibility when developing new solutions to existing problems using computing. Additionally, it is suggested that improving an interface for one target group, may improve the efficiency of interaction for another more able group (Hart, Chaparro, & Halcomb, 2008). In contrast, if a design is ineffective, it may only be an inconvenience for able people, but could have major consequences for those who are impaired (Harada, Mori, & Taniue, 2010).

The following section will discuss key factors relating to each of the four impairment areas. It will make suggestions for interaction adaptations which have the potential to benefit older people.

#### 6.4.1.1 Motor Impairments

As a person ages, their motor skills become increasingly impaired (Wandke et al., 2012; Goodwin, 2013; Vetter, Bützler, Jochems, & Schlick, 2012; Wallace et al., 2013; Leung, McGrenere, & Graf, 2009; Tenneti et al., 2012; Reeder, Zaslavsky, Wilamowska, Demiris, & Thompson, 2011; Lin et al., 2009; Meza-Kubo & Moran, 2013; J. Zhou, Rau, & Salvendy, 2012). In addition, conditions such as arthritis and Parkinson's disease will further restrict a person's motor abilities (Taveira & Choi, 2009; Piper, Campbell, & Hollan, 2010; Hough & Kobylanski, 2009; Wallace et al., 2013; Lam & Chung, 2009; Charness & Boot, 2009). This reduction in motor abilities can have a detrimental effect on the

interaction with technology (Piper et al., 2010; Wallace et al., 2013; Charness & Boot, 2009; Taveira & Choi, 2009; K. Chen & Chan, 2011; K. Chen, Chan, & Tsang, 2013; Xue et al., 2012; Ji et al., 2010; Ali, Norizan, & Shahar, 2013). PwDs will experience the natural decline in motor abilities associated with ageing. However, due to the nature of dementia with Lewy bodies (DLB), people living with this type of dementia will also experience symptoms similar to Parkinson's disease (Ancient & Good, 2013), making the consideration of motor impairments vital for these users.

A reduction in the fine motor abilities is often associated with ageing (Taylor et al., 2014; Taveira & Choi, 2009; M.-Y. Hwang, Hong, Jong, Lee, & Chang, 2009; Piper et al., 2010; M.-Y. Hwang, Hong, Hao, & Jong, 2011; Piper & Hollan, 2013; Charness & Boot, 2009; Vetter et al., 2012; Lam & Chung, 2009; Wallace et al., 2013; M.-Y. Hwang et al., 2011). Fine motor control is defined as the ability to coordinate muscle movements to make small, precise movements ("Fine Motor Control," 2015). It is recommended by Piper et al. (2010) that interfaces should avoid requiring people to make use of fine motor skills in order to eliminate this problem for older people. However, the authors do not elaborate how this can be achieved. This decline in fine motor abilities leads to difficulty in making precise movements (Meza-Kubo & Moran, 2013), particularly when using a mouse (Taveira & Choi, 2009). In order to mitigate this problem Wagner, Hassanein, and Head (2010) suggest that layouts should not require any precise mouse movements to operate. In addition, Biswas et al. (2011) recommend that no buttons should share a common boundary. This aimed to ensure that the wrong button cannot be pressed by mistake. In the study conducted by Biswas et al. (2011), they found that avoiding common button boundaries did reduce the number of missed clicks, but did not eliminate them. Whilst the result of the study was not significant, it did tend towards significance, suggesting there is the potential for buttons without common boundaries to reduce the number of missed clicks as a result of impaired fine motor control.

Together with a reduced fine motor ability, older people also experience a reduction in dexterity (Hart et al., 2008; Barnard, Bradley, Hodgson, & Lloyd, 2013; Mihailidis et al., 2010; D. Williams, UI Alam, Ahamed, & Chu, 2013; L. Wang, Rau, & Salvendy, 2011; Money, Fernando, Lines, & Elliman, 2009; Chou et al., 2012; Renaud & van Biljon, 2008). This will result in older people finding the small buttons on interfaces particularly difficult to use (van Veldhoven et al., 2008). In order to avoid this problem, it is suggested that the buttons should be designed to be bigger (Biswas et al., 2011; Charness & Boot, 2009; Renaud & van Biljon, 2008). Additionally, Lam and Chung (2009) recommend that the target area in which the person is required to press for the click to be recognised should be enlarged. However, care needs to be taken when interpreting this finding, as the study conducted used representatives of older people rather than the target users themselves. It could be suggested that combining these two recommendations may help older people to interact with technology, despite reduced dexterity. However, further research will be required in order to confirm whether this would have a positive reaction from older people.

Another area which declines as a result of the ageing process is a person's muscle strength and control (Taveira & Choi, 2009; Barnard et al., 2013; Lam & Chung, 2009; Vetter et al., 2012; Charness & Boot, 2009; Langdon & Thimbleby, 2010; Goodwin, 2013; Pijukkana & Sahachaisaeree, 2012), which can have a negative impact on data input (Vetter et al., 2012). This decline can lead to difficulty with controlling movement (K. Chen & Chan, 2011; Hertzum & Hornbæk, 2010; Wallace et al., 2013), slower response times (Pijukkana & Sahachaisaeree, 2012; Naumann, Wechsung, & Hurtienne, 2010; Taveira & Choi, 2009; Wallace et al., 2013; Langdon & Thimbleby, 2010), and a reduced ability to modulate the forces they apply (Naumann et al., 2010). Despite a wealth of information about reduced muscle strength and control, this study has found a distinct lack of discussion relating how these problems can be mitigated through interface or interaction design. In order to mitigate any negative effects due to slower response times (such as web-page time outs), it could be suggested that interfaces should be user-paced, or at the very least, have longer time out periods. However, this does not appear to have been investigated in relation to considering the effect of the reduced muscle strength and control experienced by older people.

#### 6.4.1.2 Cognitive Impairments

In addition to a decline in motor abilities, older people will also experience a deterioration of their cognitive skills (Ji et al., 2010; Greengard, 2009; Chou et al., 2012; Chun & Patterson, 2012a; Li, Rau, Fujimura, Gao, & Wang, 2012; Money et al., 2009; Higgins & Glasgow, 2012; Miller et al., 2013). For PwDs this will be accentuated by their condition (Higgins & Glasgow, 2012). This cognitive decline can make using technology difficult (Rosenberg, Kottorp, Winblad, & Nygård, 2009; D. Williams et al., 2013; Hanson, 2010; Gatto & Tak, 2008; Boontarig et al., 2012; Kuo, Chen, & Hsu, 2012; Ali, Shahar, Kee, Norizan, & Noah, 2012; Harada et al., 2010; Or & Tao, 2012; Pak, Price, & Thatcher, 2009), potentially making the use of IT “hazardous” (de Sant’Anna et al., 2010). Cognitive decline is not linear process, with different abilities being impaired at different rates (Higgins & Glasgow, 2012). Miller et al. (2013) recognise the decline as a “multifactorial process” whereby the rate and domains are determined by “mediators and moderators”. In addition, particular areas are more vulnerable to decline than others, for example whilst fluid intelligence will decline (Pak & Price, 2008; Higgins & Glasgow, 2012; Hanson, 2010; Lam & Chung, 2009; K. Chen & Chan, 2013; Langdon & Thimbleby, 2010), crystallised intelligence will remain relatively intact (Pak & Price, 2008). It is often the case that products make a significant demand on cognitive abilities (Langdon & Thimbleby, 2010). However, systems which are designed to be used by older people, especially those living with conditions such as dementia, need to take into account the amount of demand being placed. Steps need to be taken in order to minimise the effect on an impaired cognition, whilst simultaneously counteracting any cognitive changes which have occurred (Ji et al., 2010; Rosenberg et al., 2009; Etcheverry, Terrier, & Marquié, 2012; Czaja et al., 2013).

Older adults will often experience a decline in their ability to remember things (Pijukkana & Sakhaisaeree, 2012; Higgins & Glasgow, 2012; Wagner et al., 2010; L. Wang et al., 2011; Wallace et al., 2013; Charness & Boot, 2009; Chevalier, Dommès, & Martins, 2013; Piper & Hollan, 2013; Kuo et al., 2012; Chou et al., 2012). For those living with dementia, this will be worsened due to the nature of the condition (Mahmud et al., 2010). It is suggested by Mahmud et al. (2010) that memory impairments need to be mitigated in order to support PwDs to interact with new technology. This could be achieved through the use of cognitive cues (Wagner et al., 2010; Etcheverry et al., 2012), reducing the memory load (Y.-C. Hwang, 2011; C. C. H. Chan, Wong, Lee, & Chi, 2009), or transferring the need to remember items from the person to the technology (Higgins & Glasgow, 2012). These tools have the potential to reduce the reliance on the deteriorated memory, allowing older people to successfully interact with the technology.

One of the primary symptoms associated with dementia is short term memory loss (Langdon & Thimbleby, 2010), which makes interacting with technology challenging for the person living with the condition (Mahmud et al., 2010). However, as a person ages, there is also a natural decline in this ability (Taylor et al., 2014; Burns et al., 2013; Lin et al., 2009). Therefore, whilst it is vital to consider the decline in short term memory for PwDs, it is also key to supporting older adults too. This decline in short term memory will make interface navigation challenging, particularly as users will have difficulty recalling whether they have encountered information previously (Etcheverry et al., 2012). It is suggested that minimising the amount of information which is required to be remembered in the short term will reduce the load on the short term memory (Or & Tao, 2012). However, this study has a relatively small sample size (only 50 older people) and failed to take into account anyone who was living with dementia. Therefore, whilst it is logical to reduce the load on the short term memory, more research is required in order to quantitatively evaluate whether there is a measurable, positive effect on the users.

Both successful and efficient interaction relies on an unimpaired working memory (Higgins & Glasgow, 2012). However, as a person ages, they experience a deterioration in this ability (Wilkowska & Ziefle, 2009; K. Chen et al., 2013; Vetter et al., 2012; Li et al., 2012; K. Chen & Chan, 2011; Higgins & Glasgow, 2012; Harada et al., 2010; Chevalier et al., 2013; Chun & Patterson, 2012a; M.-Y. Hwang et al., 2011; Y.-C. Hwang, 2011; J. Zhou et al., 2012). This results in difficulty managing even a small set of complicated decisions, leading to the suggestion that decisions should be kept simple (Li et al., 2012). The participants involved in the study carried out by Li et al. (2012) were trained computer users, which suggests that those without experience may struggle even more. Older people are able to store fewer items in the working memory than those who are younger (Chevalier et al., 2013), which will limit the number of steps which could be remembered by the user (Higgins & Glasgow, 2012). Therefore, it is suggested that all information relating to the manipulation and transformation of information is displayed on the screen to aid the users (Higgins & Glasgow, 2012). Whilst this could be used to support older users, there is the potential that too much information could cause overload which may

be detrimental overall (Or & Tao, 2012). Therefore, further research would be required to investigate whether this would be useful to older adults.

As people grow older, the speed with which they can process information decreases (C. C. H. Chan et al., 2009; M.-Y. Hwang et al., 2009, 2011; Chun & Patterson, 2012a; Harada et al., 2010; K. Chen & Chan, 2011; Pulli, Hyry, Pouke, & Yamamoto, 2012; Burns et al., 2013; J. Zhou et al., 2012; Granata et al., 2013; Reeder et al., 2011; Lin et al., 2009; Chevalier et al., 2013; Wandke et al., 2012), due to limited resources for processing (Wallace et al., 2013). This leads to a longer reaction time between a stimulus and the response (Hart et al., 2008; Chou et al., 2012; Mertens, Brandl, Przybysz, Koch-Körfges, & Schlick, 2012; L. Wang et al., 2011; Langdon & Thimbleby, 2010; Pijukkana & Sahachaisaeree, 2012). In order to counteract the effect of the deteriorated processing speed, it has been recommended that an adequate time should be left between the end of an instruction and the beginning of the task (Reeder et al., 2011). However, as discussed earlier, there is a large diversity in the abilities of older people (Wallace et al., 2013; Greengard, 2009; Miller et al., 2013; Ancient & Good, 2013), which makes deciding on an appropriate time allowance difficult. A time gap of 2 seconds may be sufficient for one person, but inadequate for another. In an attempt to manage this challenge, Ancient and Good (2013) suggest eliminating the need for a task to be completed within a specific amount of time. Through implementing a user-paced system, people with severely impaired processing abilities will be able to interact with the system at their own speed, rather than attempting to keep up with the speed of the device. However, to date, there have been no quantitative studies which investigate this possibility.

A reduced ability to inhibit irrelevant information will also affect the way that an older person can interact with technology (Wilkowska & Ziefle, 2009; Chevalier et al., 2013; Renaud & van Biljon, 2008; Higgins & Glasgow, 2012; Hara & Kashimura, 2010; M.-Y. Hwang et al., 2011). This results in an increased dependence on selective attention to compensate for an inability to ignore distracting details (K. Chen & Chan, 2011). Generally, it is suggested that interfaces should be simplified with a plain background (Y.-C. Hwang, 2011; Waniek, 2008; Orpwood et al., 2010). In addition, older people will find it difficult to discriminate between stimuli that are relevant and those which are not (Wandke et al., 2012; K. Chen & Chan, 2011; Waniek, 2008; M.-Y. Hwang et al., 2009), leading to the person remembering irrelevant information (Wandke et al., 2012). It can, therefore, be suggested that relevant stimuli should be made more salient (Chevalier et al., 2013; Orpwood et al., 2010; Hara & Kashimura, 2010). Alternatively, any details which are irrelevant for the current task should be removed from view (Higgins & Glasgow, 2012). However, due to the small sample sizes used to test these recommendations, further research needs to be carried out to ensure that a benefit is experienced by older people upon implementation.

Another consequence of ageing is a reduced ability for learning and skills acquisition (van Veldhoven et al., 2008; Jung, Kyung-Kyu, Hyun-Roc, & Dongho, 2009; Wallace et al., 2013; Hart et al., 2008;

L. Wang et al., 2011; Ali et al., 2013; Higgins & Glasgow, 2012). In addition, the brain plasticity of an older person is reduced, thus making it increasingly difficult to integrate new learning with existing knowledge (Wandke et al., 2012). However, as highlighted by Renaud and van Biljon (2008), it is important to note that the capacity to learn doesn't decrease, just the speed of learning. This reduced rate of learning was also encountered by Gilly, Celsi, and Schau (2012), whose participants expressed feeling their "ability to learn, recall and perform skills needed to succeed with technology" was slower than younger people. However, this research involves anecdotal reports of slower learning, suggesting that research is required to quantitatively verify this claim. In order to compensate for the reduced learning speed, it is recommended that interfaces should be designed to provide a quick to learn and easy to understand interaction for older people (Piper & Hollan, 2013; Wagner et al., 2010).

#### 6.4.1.3 Visual Impairments

Ageing will often have a detrimental effect on the visual abilities of a person (Or & Tao, 2012; J. Zhou et al., 2012; Lorenz & Oppermann, 2009; Wallace et al., 2013; Ziefle, 2010; K. Chen & Chan, 2011; Pijukkana & Sahachaisaeree, 2012; Hart et al., 2008; Ryu, Kim, & Lee, 2009; Chun & Patterson, 2012a; Taylor et al., 2014). Visual impairment is cited by L. Wang et al. (2008) as "one of the most common and clear-cut declines associated with aging". This makes interacting with technology difficult for older people (Hough & Kobylanski, 2009; Pijukkana & Sahachaisaeree, 2012; L. Wang et al., 2011; Chou et al., 2012; Renaud & van Biljon, 2008), particularly as the visual difficulties experienced are not taken into account when designing interfaces (Tseng, Hsu, & Chuang, 2012). In some cases, the person may have retained the cognitive ability to interact with technology, but the poor visual design prevents them from completing the task (Reeder et al., 2011). In addition to the natural ageing process, older people can also suffer from conditions which have a detrimental effect on their vision, such as age-related macular degeneration (J. Zhou et al., 2012; Nasmith & Parkinson, 2008; L. Wang et al., 2008). With most devices often relying on graphical or text-based interfaces (K. Chen & Chan, 2011), it is important to consider the needs of older people with regards to their decline visual abilities.

Visual acuity is the ability to perceive small details ("Visual Acuity," 2014). Ageing is associated with a decline in visual acuity (Wandke et al., 2012; Charness & Boot, 2009; Vetter et al., 2012; Zhao, Rau, Zhang, & Salvendy, 2009; Taveira & Choi, 2009; S. Zhou, Chen, Liu, & Tang, n.d.; Lam & Chung, 2009; K. Chen & Chan, 2011; D. Williams et al., 2013; J. Zhou et al., 2012; Lorenz & Oppermann, 2009; Tenneti et al., 2012), with Tseng et al. (2012) suggesting the deterioration typically starts when a person reaches around 40 years old. Both static and dynamic visual acuity are affected by the ageing process (Wallace et al., 2013; Langdon & Thimbleby, 2010; Ji et al., 2010). This decline is important to consider for electronic information displays (Vetter et al., 2012) and can lead to an increased difficulty in finding small targets on a graphical user interface (Hollinworth & Hwang, 2010; D. Williams et al., 2013; Taveira & Choi, 2009), which would be especially problematic on mobile devices. In order to

alleviate this problem, it could be suggested that interface items are made larger (D. Williams et al., 2013; Or & Tao, 2012; K. Chen et al., 2013; Dickinson, Eisma, & Gregor, 2011; Ali et al., 2012; Mertens et al., 2012). Alternatively, the users could be provided with the opportunity to resize objects to suit their vision (Reeder et al., 2011).

A reduction in the sensitivity to contrast is also experienced as a result of increasing age (Burns et al., 2013; Crossland & Rubin, 2012; K. Chen & Chan, 2011; L. Wang et al., 2008; D. Williams et al., 2013; Piper et al., 2010; Langdon & Thimbleby, 2010; Lin et al., 2009; J. Zhou et al., 2012). This can lead to difficulties when trying to distinguish different elements, such as buttons, on an interface (Ali et al., 2013). It also results in older people struggling to read text (Crossland & Rubin, 2012). In order to alleviate this problem two solutions are proposed by the literature. Firstly, increasing the size of the element (Fromme, Kenworthy-Heinige, & Hribar, 2011; Hough & Kobylanski, 2009; Ali et al., 2013; Y.-C. Hwang, 2011; Santa-Rosa & Fernandes, 2012; Sayago, Guijarro, & Blat, 2010; Ji et al., 2010). Alternatively, interface designers could choose the colours used carefully to ensure a high contrast (Fromme et al., 2011). This is particularly important for text. Though the use of a high contrast between the background colour and the foreground text, designers can improve the readability of the interface (Fromme et al., 2011; Ali et al., 2012; Y.-C. Hwang, 2011). In addition, the use of high contrasts between the background and foreground could ensure that controls “stand out” (Orpwood et al., 2010). However, the sample sizes for all these studies are relatively small, suggesting that further research is required to ensure that these recommendations do benefit older people.

In addition to reduced contrast sensitivity, older people will experience a reduced ability to perceive differences in colour (Ali et al., 2013; K. Chen & Chan, 2011; Piper et al., 2010; Lin et al., 2009; Fromme et al., 2011; Lorenz & Oppermann, 2009; Wallace et al., 2013; Vetter et al., 2012), particularly when similar colours are used (Chou et al., 2012). As people age, the lens in their eye will darken and turn slightly yellow (Fromme et al., 2011; Lorenz & Oppermann, 2009). This yellowing of the lens will result in particular difficulty distinguishing colours which only have differences in the blue content (Fromme et al., 2011), highlighting the need to ensure colour differences are easily recognisable (Chou et al., 2012). Additionally, Fromme et al. (2011) recommend that primary colours are utilised in interface design, with a particular focus on yellows and reds. The use of dark colours within the interface is considered tiring by older people (Ali et al., 2012; Lorenz & Oppermann, 2009). Ali et al. (2012) suggest the use of bright colours to compensate for this effect. However, further research by Ali et al. (2013) found that older people can feel uncomfortable with interfaces which are too bright, suggesting that calm colours should be utilised. In contrast, Jung et al. (2009) found that bright colours were preferred by older people. This demonstrates that further research is required to optimise the colours used within interfaces for older people. In the meantime, it could be recommended that both bright and calm colours are provided to the users, with the option to choose which option they prefer.

#### 6.4.1.4 Auditory Impairments

The final group of impairments which will affect older people is auditory. As people age, their hearing abilities decrease (K. Chen & Chan, 2011; Chun & Patterson, 2012a; D. Williams et al., 2013; Hart et al., 2008; Piper et al., 2010; Mahmud et al., 2010; Pijukkana & Sahachaisaeree, 2012; Ji et al., 2010; Lorenz & Oppermann, 2009; Wallace et al., 2013; Ryu et al., 2009; K. Chen et al., 2013; Burns et al., 2013; Taylor et al., 2014; Renaud & van Biljon, 2008). However, despite 50% of men and 30% of women experiencing hearing loss that significantly hinders social interaction, older people will often downplay the hearing loss they have (D. Williams et al., 2013). In order to counteract the effects of hearing loss due to ageing, it is suggested that the volume of any interaction elements utilising sound should be increased (D. Williams et al., 2013; K. Chen & Chan, 2013; Mihailidis et al., 2010). However, there is research to suggest that older people are more sensitive and less tolerant to loud sounds (Wallace et al., 2013; Ali et al., 2013). This implies that a careful balance needs to be struck between a volume which is sufficiently loud enough to be heard, whilst not proving uncomfortable. This will require further research to establish the optimal volume. The diverse nature of the user group could make establishing this a challenging prospect. Alternatively, D. Williams et al. (2013) recommend that the users should be able to adjust the volume levels to suit them, which could overcome the issue of user diversity.

Older people will experience a shifting in the range of frequencies they can perceive, even if there is no hearing loss (D. Williams et al., 2013). This decline will start with higher frequencies (D. Williams et al., 2013; Charness & Boot, 2009; Wallace et al., 2013; K. Chen & Chan, 2011), and gradually move to the middle range frequencies as the person ages (Tenneti et al., 2012; Langdon & Thimbleby, 2010). This decline in ability will make hearing high frequency alert tones challenging for older adults (Wallace et al., 2013; Ali et al., 2013). Therefore, it can be suggested that alert tones should be pitched appropriately for this demographic, with only sounds which are within the frequencies that can be perceived used (D. Williams et al., 2013; Wagner et al., 2010). It would be preferable for lower frequency tones to be utilised (Lam & Chung, 2009). However, despite these recommendations, there is no empirical research with the target users to validate the suggestions. In order to confirm the benefit of changing the alert tones to suit older adults changing hearing, further research is required.

In a noisy environment, hearing in older people is further reduced (K. Chen & Chan, 2011; Charness & Boot, 2009). An inability to differentiate foreground sound with background noises makes following conversations particularly difficult for older people (Ali et al., 2013; Tenneti et al., 2012). For PwDs, this inability to keep up with conversations will be enhanced by their condition. It is, therefore, suggested that background distractions should be minimised where possible in order to support the older person (Charness & Boot, 2009; Wallace et al., 2013). Additionally, when interacting with technology in a noisy environment, it could be recommended that headphones are worn (Waniek, 2008). This will



block out the unnecessary sounds, encouraging the person to focus on the interface. However, this recommendation has not been tested, which would be required to ensure that the older person does benefit from this type of strategy to eliminate distracting background noise.

### 6.4.2 Usability

Usability is defined as: “[t]he extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” (UsabilityNet, 2006). In this case, the focus is to ensure that older people and those who are living with dementia, are able to use the developed system. According to Ziefle (2010), there is now a greater emphasis on developing designs which are both usable and useful. Often, the difficulties which are encountered are as a result of poor design (Castilla et al., 2013). Through considering the usability of a design, these difficulties can be mitigated and, in some cases eliminated.

This section will focus on the following elements of usable designs: ease of use, ease of understanding, intuitiveness and ease of learning, task performance, navigation, help, complexity, readability, and input and output modalities.

#### 6.4.2.1 Ease of Use

It is often reported that older people struggle to use technology easily (Greengard, 2009; Or & Tao, 2012; Naumann et al., 2010). Difficulties include turning the device on (Barnard et al., 2013), text messaging (Ji et al., 2010), and interactions being more challenging to work out than perform (Piper et al., 2010). It is, therefore, recommended that interfaces and devices are easy to operate (Xue et al., 2012; Pan & Jordan-Marsh, 2010; Taylor et al., 2014; M.-Y. Hwang et al., 2011; Patomella, Kottorp, Malinowsky, & Nygård, 2011) and provide simple layouts (Y.-C. Hwang, 2011; Waniek, 2008; Charness & Boot, 2009; D. Williams et al., 2013; Orpwood et al., 2010; Boontarig et al., 2012; C. C. H. Chan et al., 2009; Rosenberg, Kottorp, & Nygård, 2012; Meza-Kubo & Moran, 2013; Lam & Chung, 2009; Or & Tao, 2012; Chou et al., 2012). This simplicity should be emphasised to users in order to reduce the demand placed on them (Hart et al., 2008). Ensuring that interfaces are easy to use is not just limited to older people. The concept is ubiquitous in guidelines, including those developed by Shneidermann and Nielsen, which are regularly cited as the heuristics to use when designing usable interfaces.

In an effort to simplify the interface, C. C. H. Chan et al. (2009) suggest ensuring that each screen should only complete one transaction. In their study consisting of 187 elderly participants, they found that a simplified ATM machine, which implemented this suggestion was easier to use and users were more likely to succeed in their task. Orpwood et al. (2010) extend this, suggesting that each screen should only have one control if it is to be used by PwDs. Whilst this could be a useful idea, it would only work in circumstances where the task to be completed allowed this. In situations where the user

can either go backwards or forwards in the interface, this one control per screen suggestion would not be possible to implement and achieve the desired functionality. Therefore, whilst simplicity is an important attribute, care needs to be taken to ensure that users are still able to complete all the tasks they wish.

#### 6.4.2.2 Ease of Understanding

Older people tend to struggle with understanding technology (M.-Y. Hwang et al., 2011; Arning & Ziefle, 2009; Xue et al., 2012; K. Chen & Chan, 2014; Calero Valdez et al., 2009; Patomella et al., 2011), particularly in relation to applications (S. Zhou et al., n.d.). It is therefore, recommended that systems are developed to be easy for novice users to understand (Langdon & Thimbleby, 2010). Information which is presented on the system should be done so in a manner which is easy for the user to understand and eliminates any possibility of ambiguity (Taylor et al., 2014). In addition, through providing the user with visibility of the actions carried out by the computer, they will have a greater understanding of what operations are being carried out (Ali et al., 2012). This will in turn make the system more transparent to the user. Finally, to complement the transparency of the system, it would be advisable to provide the user with information relating to the functionality provided by buttons (Y.-C. Hwang, 2011).

Unfamiliar computing terminology was a significant source of difficulty for older adults (Wandke et al., 2012; Or & Tao, 2012; Castilla et al., 2013; Papa et al., 2012; Ancient & Good, 2013). This lead to increased levels of confusion (Barnard et al., 2013; D. Williams et al., 2013), and feelings of intimidation (Hakkarainen, 2012). This is compounded through the interchangeable nature of some computer jargon (Reeder et al., 2011). In an attempt to overcome this, it is suggested that plain, non-technical words are used throughout the interaction process (Or & Tao, 2012; Miller et al., 2013; D. Williams et al., 2013). Additionally, simple language should be used, which is generalised to allow novice users the opportunity to easily understand the function (Waniek, 2008; Ali et al., 2012). New technical terminology will be especially difficult for PwDs, as a symptom which is associated with the condition is difficulty in find the most appropriate word (Ancient & Good, 2013). Therefore, it is particularly important to utilise familiar words rather than new and complicated computer jargon when designing interfaces for both the elderly and those living with dementia. It is suggested that terms which are appropriate to the experiences of the users would be the best option to replace technological terminology (Castilla et al., 2013). This recommendation was established as a possible adaptation to the interface which was tested as part of the study by Castilla et al. (2013), and as such, has not been tested to ensure validity. Therefore, it would be advisable for this conclusion to be tested using the target audience to establish it's benefit.

### 6.4.2.3 Intuitiveness and Ease of Learning

In order to counteract an older person's unfamiliarity with technology, it could be suggested that an intuitive interface should be utilised (S. Zhou et al., n.d.; Langdon & Thimbleby, 2010; Chaiwoo et al., 2011; Meza-Kubo & Moran, 2013; Barnard et al., 2013). This will result in the required action naturally presenting itself to the user (Barnard et al., 2013). Thus, the user should be able to know exact how to interact with the system from the moment they see the screen (Meiland et al., 2012). There is, however, the opportunity for this to be supplemented through the use of interaction cues (Piper et al., 2010; Fromme et al., 2011). The usability of the device can be improved through this use of familiar interaction techniques (van Veldhoven et al., 2008). Additionally, it is hoped that if an interface is intuitive the technology becomes invisible to the user, allowing them to concentrate on the task they are required to complete (Castilla et al., 2013). This is particularly important for older people, who can become distracted easily (Hart et al., 2008; Chevalier et al., 2013; Li et al., 2012; D. Williams et al., 2013; Higgins & Glasgow, 2012). Therefore, the use of an intuitive interface may reduce the possibility of the interface becoming a source of distractions. Finally, where possible, interfaces should be matched to the real world in order to increase the intuitiveness for the user (Or & Tao, 2012). For example, placing the next button on the left hand side of the screen and the previous on the right would increase the intuitiveness of these two interaction elements (Money et al., 2009).

A significant problem for older people is their reduced ability to learn new interaction paradigms (Hollinworth & Hwang, 2010; Wandke et al., 2012; Harada et al., 2010). However, according to Harada et al. (2010), with only a few small modifications, it is possible to develop an interface which can support the learning process of older adults. Through the simplification of interfaces, and consideration of both the task to be completed and the user experience, the learning process can be improved (Gatsou, Politis, & Zevgolis, 2011; Harada et al., 2010; van Veldhoven et al., 2008). Additionally, research suggests that people are able to learn new techniques when they are able to make use of their existing knowledge, applying it to new concepts (Hollinworth & Hwang, 2010). Through utilising previous interaction methods and familiar patterns, ease of learning can be improved, thus ensuring that older people are able to use new technologies (Hollinworth & Hwang, 2010; Meza-Kubo & Moran, 2013; Vastenburg et al., 2008; Barnard et al., 2013; M.-Y. Hwang et al., 2011; S. Zhou et al., n.d.; Siek et al., 2010; M.-Y. Hwang et al., 2009; Gatsou et al., 2011).

In learning situations, older people are prone to cognitive overload (Czaja et al., 2013). This will be particularly problematic for PwDs, as their cognitive abilities can be significantly reduced as a result of the condition (Mahmud et al., 2010; Langdon & Thimbleby, 2010). Therefore, through reducing the amount of effort which is required in order to learn new technologies (M.-Y. Hwang et al., 2011), the cognitive loading of older adults, particularly those with dementia, can be supported.

#### 6.4.2.4 Task Performance

Older people will often experience poorer task performance than younger adults (K. Chen et al., 2013; Chun & Patterson, 2012b; Miller et al., 2013; Wagner et al., 2010). This will particularly be experienced when there is very little time between instructions being provided and the task commencing, resulting in the person being “thrown off” their task (Reeder et al., 2011). However, this effect can be overcome. Research suggests that through allowing older people to control the pace of their interaction, their performance can be improved, with the elderly able to process information as well as younger adults as a result (Gilly et al., 2012). Whilst this may lead to an increase in time taken to complete the task, older people tend to prioritise accuracy over speed (Piper et al., 2010; Chun & Patterson, 2012a). Therefore, systems should ensure that no responses are time-limited (Ancient & Good, 2013), to allow older people to interact at their own rate.

It will often be the case that older people will spend more time completing tasks (Li et al., 2012; Calero Valdez et al., 2009; Wagner et al., 2010; Chevalier et al., 2013; Zhang, Rau, & Salvendy, 2009; Hanson, 2010; Hart et al., 2008; Hasegawa, Miyao, Matsunuma, Fujikake, & Omori, 2008; K. Chen et al., 2013; Nagle & Schmidt, 2012; Chun & Patterson, 2012a), particularly when carrying out machine-paced tasks (Lin et al., 2009). Through slowing down the interaction speed, this increased amount of time required can be catered for (C. C. H. Chan et al., 2009; Piper et al., 2010). Hanson (2010) found that older people will take longer to complete tasks which are ill-defined. However, later research conducted by Chevalier et al. (2013), suggests that well-defined tasks lead to slower completion speeds. Both studies included small numbers of participants, which suggests that further research is required before any conclusions can be drawn as to whether ill- or well-defined tasks should be utilised when designing technology interactions.

Older people will particularly struggle with diminished search performance (Chevalier et al., 2013; Miller et al., 2013), including slower search speeds (Hasegawa et al., 2008) and regular unsuccessful attempts to find the information they require (Hart et al., 2008). In order to search for information and process the results, a large amount of cognitive resources are required (Chevalier et al., 2013; Sharit, Hernandez, Czaja, & Pirolli, 2008), a skill which is lacking for older people. Older people are also at increased risk of forgetting the information already gained, and ultimately, the purpose of their search (Chevalier et al., 2013). This will be particularly problematic for PwDs, as short term memory loss is a significant issue for this demographic. It is recommended that in order to combat this effect, all required information should be clearly displayed within the interface (M.-Y. Hwang et al., 2009, 2011). This will improve the search performance of those who have forgotten key elements of their requirements, but also those who have reduced capacity in this area of interaction.

#### 6.4.2.5 Navigation

Navigation is a key aspect of interface interaction that older people often struggle with. This will be experienced in cases where the navigation requires the use of spatial abilities (Lin et al., 2009), an ability which declines in old age (Vetter et al., 2012; Y.-C. Hwang, 2011; van Veldhoven et al., 2008). It is recommended that navigation should be designed to be easy for older adults to use (Wallace et al., 2013; Chou et al., 2012). Additionally, navigation which aims to be intuitive can support interaction with the system (Ji et al., 2010; Hough & Kobylanski, 2009).

Hierarchical menu structures are counter-productive and can hamper performance for older adults (Arning & Ziefle, 2009; Siek et al., 2010). This can result in the users taking more detours, becoming distracted from the correct navigation task, and therefore, taking longer to find the location they were aiming for (Arning & Ziefle, 2009; Boontarig et al., 2012) and, hence, increased cognitive requirements (Chevalier et al., 2013; Lin et al., 2009). In an attempt to overcome this, the user will tend to spend longer on each page, ensuring they are convinced they are navigating on the correct path (Chun & Patterson, 2012b). Research conducted by Chun and Patterson (2012a) found that older adults needed to allocate 51% more time to navigation than younger adults. Therefore, methods are required to ensure that the navigation is easy for older adults to use, thus reducing the amount of time and cognition required to operate interfaces (Wallace et al., 2013; Chou et al., 2012). It is recommended that hierarchical navigation is avoided, where possible, and replaced with a tag-based system (Pak & Price, 2008; Pak et al., 2009). This alternative navigation method allows older people to utilise the crystallised intelligence and vocabulary which has increased rather than diminished as they aged (Chevalier et al., 2013). Additionally, tag-based systems allow each page to have a many-to-one relationship, improving the chances of the person finding the desired information easier (Chevalier et al., 2013; Pak & Price, 2008). Research does suggest that older adults performance within the tag-based model is improved when compared to existing hierarchical systems (Pak et al., 2009; Pak & Price, 2008). However, small sample sizes and a lack of validation mean that further research is required to confirm the benefit.

Interfaces which implement deep menu structures are difficult for older people to use (J. Zhou et al., 2012). Small screen devices are especially challenging, as only a few menu items can be shown at any one time, reducing the person's ability to see all the possible options (Wilkowska & Ziefle, 2009; Ziefle, 2010), thus hiding the menu structure from the user (Wilkowska & Ziefle, 2009; Barnard et al., 2013). It is recommended that shallower navigation depth is utilised when designing interfaces for older people (Lam & Chung, 2009; J. Zhou et al., 2012; Siek et al., 2010), therefore, avoiding deep menu structures (Chou et al., 2012; Jung et al., 2009). Additionally, Lorenz and Oppermann (2009) suggest eliminating layered navigation through using only one screen with all options included. However, this has the potential to cause more problems than it solves, with an increased number of options at each layer, resulting in a broad navigation structure (J. Zhou et al., 2012). Hence, Castilla et al. (2013) built

on this recommendation, suggesting that the complexity can be reduced through the use of only one or two options per menu level. This will reduce the number of options, whilst empowering the user to continue making decisions (Mihailidis et al., 2010).

#### **6.4.2.6 Mental Models**

A mental model is established by users to allow them to predict the operations of an interface under particular conditions. Research suggests that an accurate mental model provides a significant advantage for older adults, in some cases, allowing them to overcome their “age handicap” (Arning & Ziefle, 2009). However, the development and storage of this mental model requires significant memory resources (Higgins & Glasgow, 2012), which experience decline as a person ages (Wilkowska & Ziefle, 2009; K. Chen et al., 2013; Vetter et al., 2012; Li et al., 2012; K. Chen & Chan, 2011; Higgins & Glasgow, 2012). Therefore, older people often struggle to generate an accurate and supportive mental model, resulting in difficulty with interaction (Harada et al., 2010; Arning & Ziefle, 2009; D. Williams et al., 2013; Leung et al., 2009; Calero Valdez et al., 2009; Barnard et al., 2013; Etcheverry et al., 2012). Providing support to generate an accurate mental model may help older adults interact with systems. However, research by Leung et al. (2009) suggests that older people may also find utilising mental models challenging. Therefore, providing support to generate the mental model may not be sufficient to help older adults interact with technology. Chun and Patterson (2012b) recommend that interfaces make use of and match the existing mental models. However, this could be extended to suggest that interfaces should be design in a manner such that the generation of a mental model is not required, with the interactions that are implicit to the user.

#### **6.4.2.7 Help**

The help functionality provided within applications is vital to older people, who often have less experience with computers than their younger counterparts (M.-Y. Hwang et al., 2009, 2011; Taveira & Choi, 2009; Arning & Ziefle, 2009). However, despite this important need for supportive help functionality, older adults rarely find this feature supportive or useful (L. Wang et al., 2011; J. Zhou et al., 2012; O'Brien, Knapp, Thompson, Craig, & Barrett, 2013; Chun & Patterson, 2012b; Dickinson et al., 2011). It is suggested that involving older people in the development process of help functionality should allow developers to provide appropriate support and understanding (Taylor et al., 2014). This is an interesting point, which requires further investigation as to whether it will provide the appropriate support. The wide variety of needs and abilities within the target user group makes it challenging to provide the most appropriate level of support. Additionally, the people who advise on the help functionality should represent a variety of different abilities, in order to ensure that this diversity is taken into account.

Poor help functionality can have a detrimental effect on the interaction of older adults with technology

(O'Brien et al., 2013; Chun & Patterson, 2012b). This can lead to confusion (O'Brien et al., 2013), and hinders recovery from errors (Chun & Patterson, 2012b). Both Wandke et al. (2012) and Charness and Boot (2009) found that providing extra support and guidance improved the interaction for older people. However, this can be extended to include providing clear and specific guidance as to how to interact with the system (Kuo et al., 2012; Reeder et al., 2011). An additional suggestion is to provide an avatar to support the interaction (Castilla et al., 2013). This possible support mechanism could be utilised to provide timely guidance to allow the user to complete the task. However, research needs to be conducted to assess whether PwDs do find this useful or whether it provides an additional distractor to the interface.

It has been found that support before commencing a task is not supportive to older adults (J. Zhou et al., 2012). This would be particularly important for those who are living with the symptoms of dementia, who will often experience a reduction in their short term memory abilities (Mahmud et al., 2010; Langdon & Thimbleby, 2010). Through providing support at the beginning of the task to a PwD, at the point that is becomes required they may have forgotten the pertinent information, rendering their further interaction with the technology difficult. Therefore, the provision of support throughout the process of completing a task would be much more useful for this user group (Ali et al., 2012). However, due to the important nature of a useful help functionality, more research is required to ensure the support provided is adequate and presented in a timely, appropriate manner.

#### **6.4.2.8 Complexity**

When an interface is extremely complex, it can have a detrimental effect on the performance of older adults when interacting with technology (Castilla et al., 2013; Patomella et al., 2011; Stamato & de Moraes, 2012). It is suggested by Li et al. (2012) that complexity is a central feature which impacts the successful completion of a task. For older adults, particularly those who are living with dementia, the complexity is an important factor. It is often the case that a more complex interface will place a higher demand on working memory (Zhao et al., 2009), which declines in old age (Wilkowska & Ziefle, 2009; K. Chen et al., 2013; Vetter et al., 2012; Li et al., 2012; K. Chen & Chan, 2011; Higgins & Glasgow, 2012). Through designing an appropriate interface which considers complexity, interaction by older adults can be supported (Vastenburg et al., 2008).

Increased complexity of an interface makes everyday technologies difficult for older people to manage (Patomella et al., 2011). Therefore, a reduction in interface complexity is often cited as a way of improving the ease and quality of interaction with technology (van Veldhoven et al., 2008; Qian & WenDao, 2012; Lorenz & Oppermann, 2009; Patomella et al., 2011). When this complexity is reduced Li et al. (2012) found that older people performed the required tasks quicker and more efficiently. All 48 participants included within this study had extensive previous experience of using computers.

Despite this previous knowledge, a significant improvement was encountered. This could suggest that a reduction in the complexity of an interface will improve the interaction of those without computing knowledge. Future research could investigate whether this is the case, and whether PwDs were also positively impacted by this change.

The complexity of an interface is increased when additional functions and features are added, with research finding that, often, too many are included (Q. Wang, 2008; K. Chen et al., 2013; Holzinger, Ziefle, & Röcker, 2010; Mitzner et al., 2010; J. Zhou et al., 2012; Lam & Chung, 2009; Newell, Gregor, Morgan, Pullin, & Macaulay, 2011; K. Chen & Chan, 2013; Ziefle, 2010). This will lead to a complex menu structure (K. Chen et al., 2013), unnecessary features (Wandke et al., 2012), difficulty with learning the various functions (Newell et al., 2011; K. Chen & Chan, 2013), high cognitive loading (Holzinger et al., 2010; Higgins & Glasgow, 2012), and not using all the provided features (Lam & Chung, 2009; J. Zhou et al., 2012; Wagner et al., 2010; Renaud & van Biljon, 2008; K. Chen & Chan, 2013). Through including only the relevant functions to the designed application, the complexity of the interface can be reduced (M.-Y. Hwang et al., 2011; Wandke et al., 2012; Lam & Chung, 2009; Waniek, 2008; Chevalier et al., 2013; D. Williams et al., 2013; J. Zhou et al., 2012). This could include providing critical features, basic functions, and frequent commands (K. Chen et al., 2013; Waniek, 2008).

#### 6.4.2.9 Readability

Readability refers to how readable text is for a sustained period. As a result of a decline in visual abilities, older people will often encounter readability issues with text (K. Chen et al., 2013; L. Wang et al., 2008; Castilla et al., 2013). It has been previously stated that improving the readability of interfaces should benefit all older adults (Ancient & Good, 2013). For PwDs, improving this interaction feature should provide the brain with more information to produce a more accurate cognitive representation of the interface (Ancient & Good, 2013).

The size and shape of a font will have an impact on the readability of the text. Often, older adults will find that text is too small for them to read easily (Shahid et al., 2009; Pulli et al., 2012; Lam & Chung, 2009; K. Chen et al., 2013; Plaza, Martín, Martin, & Medrano, 2011; Burns et al., 2013; Ji et al., 2010), resulting in a higher likelihood of errors (Hasegawa et al., 2008). In order to combat this effect, it is suggested that small fonts should be avoided (Ziefle, 2010) and replaced with larger fonts (Ali et al., 2012; K. Chen & Chan, 2013; Mihailidis et al., 2010; Wagner et al., 2010; Zhao et al., 2009; Hasegawa et al., 2008; J. Zhou et al., 2012; Charness & Boot, 2009; Mertens et al., 2012). Many authors attempt to quantify the minimum font size for older adults (e.g. J. Zhou et al. (2012), L. Wang et al. (2008), Taylor et al. (2014), Fromme et al. (2011)). However, the range of results suggests that no consensus with regards to the optimal size is possible. Therefore, as suggested by



Piper et al. (2010), it would be preferable to recommend a system which allows users to dynamically adjust the font based on their own personal needs. It is often the case that older adults do not take advantage of options to customise their experience. Hence, the opportunity to customise the interface should be obvious to users. Additionally, this customisation feature should not increase the complexity of the interface for older users, as discussed earlier in this chapter (see section 6.4.2.8).

In addition to the size of the font, the density of text will have an effect on the readability. It has been suggested that a high text density will interfere with fluency of reading, and increase an older person's response times (Y.-C. Hwang, 2011; Ziefle, 2010). Through reducing the density of text the readability should be improved (Ancient & Good, 2013). There are a number of methods which could be employed to achieve this: limiting the number of words per page (Y.-C. Hwang, 2011), the use of lists (Lam & Chung, 2009), appropriate use of colour and headings (Burns et al., 2013), and creating smaller blocks of text (Waniek, 2008). However, more research is required to investigate which technique, or combination of techniques, should be used to maximise the benefit for older adults.

#### **6.4.2.10 Input and Output Modalities**

The modality of interaction will have a significant impact on the usability of a device for older people. It is important to consider both the input and output devices which are to be used (Reeder et al., 2011). J. Zhou et al. (2012) found that an older person's preference for input is dependant on the task to be performed. It is, therefore, suggested that the decision of which input modality should be taken once the developer knows which tasks are to be performed. Additionally, it has been concluded that older users desired a focus on easier input methods (Siek et al., 2010), with direct methods proving beneficial when compared to those which are indirect (Taveira & Choi, 2009).

Touchscreen technology is a direct method for IT interaction, which has the potential to be of benefit to older adults (Siek et al., 2010; Ali et al., 2013), particularly novice users (J. Zhou et al., 2012). It is suggested that it provides a low barrier to adoption (Piper et al., 2010) through intuitive interaction (Naumann et al., 2010; J. Zhou et al., 2012; Ali et al., 2012; Orpwood et al., 2010) and direct manipulation of objects (Ali et al., 2012). However, there are problems associated with touch screen devices. There are times when older people struggle to operate the interface reliably (Barnard et al., 2013), resulting in errors (Taveira & Choi, 2009) and frustration if there is a lack of response from the system (M.-Y. Hwang et al., 2011). Additionally, in a study conducted by Piper et al. (2010), the participants struggled with single finger interaction leading to "jumps" when repositioning images on the screen due to other fingers accidentally touching the screen. To resolve this problem, it could be recommended that interfaces which rely on touch screen technologies are designed to be insensitive to accidental touches, or developed to not require an actions which could be affected by this. Taveira and Choi (2009) found that some users struggled when their hand covered interaction elements. Therefore,

the interface should be designed to ensure that the input hand does not obstruct the users view of the screen (Lorenz & Oppermann, 2009).

The size of the device in which older adults interact with is important. It has been found that a device which has a small form factor and/or display size can increase the difficulty of interaction for older people (Ziefle, 2010; Lam & Chung, 2009; Nasir, Hassan, & Jomhari, 2008; Wilkowska & Ziefle, 2009; Holzinger et al., 2010), particularly when browsing on a mobile phone (J. Zhou et al., 2012). This results in increased cognitive load due to small amounts of information being presented on the screen (Calero Valdez et al., 2009; Ziefle, 2010; Wilkowska & Ziefle, 2009), buttons (both hardware and software) being too small and in close proximity (Lam & Chung, 2009; Nasir et al., 2008; Castilla et al., 2013; Lorenz & Oppermann, 2009; Barnard et al., 2013), and small fonts (Lam & Chung, 2009). Additionally, older people experienced a lack of comfort when holding the small devices (Plaza et al., 2011; K. Chen et al., 2013), and people with motor impairments find the devices “cumbersome” (D. Williams et al., 2013). Despite knowledge of these problems, there is little research investigating potential recommendations to mitigate or eliminate these issues. Future research should remedy this dearth of knowledge and seek to optimise the device size to ensure mobility, accessibility, and usability for older adults.

### 6.4.3 User Experience

UX considers “the experience the product creates for the people who use it in the real world” (Garrett, 2010). It aims to take into account the subjective views of the user, the system characteristics and the environment within which the technology needs to operate (Barnard et al., 2013). In addition, it is suggested that interfaces should transcend functionality and elicit an emotional response from the users (Barnard et al., 2013; Hernández-Encuentra, Pousada, & Gómez-Zúñiga, 2009), aiming to produce an enjoyable or pleasurable experience (Meza-Kubo & Moran, 2013; van Veldhoven et al., 2008; K. Chen & Chan, 2013). Research by Slegers, van Boxtel, and Jolles (2012) found that older adults use their computers more for playing games, leading Ramón-Jerónimo, Peral-Peral, and Arenas-Gaitán (2013) to conclude that a more enjoyable experience could motivate seniors to overcome any barriers to interaction encountered. This highlights the importance of ensuring that interaction with technology is a positive experience for older adults as it has the potential to improve acceptance of computing devices. D. Williams et al. (2013) further added user preferences should be taken into account, in order to present the user with “an overall easier computing experience”. This is particularly important when an application is designed to be used by older people. The diversity of needs encountered by this group of target users is wide, meaning that a one-size-fits-all experience is difficult to develop. Therefore, providing opportunities for users to customise the appearance of the interface has the potential to improve the experience generated by the device.

Ji et al. (2010) recognise the position of accessibility as a pre-condition to UX, whilst Barnard et al. (2013) suggest that it should build on usability. Both these articles imply that user experience should build on, and complement both accessibility and usability factors. Despite many studies recognising that UX is an important consideration when designing interfaces (Meza-Kubo & Moran, 2013; Wilkowska & Ziefle, 2009; van Veldhoven et al., 2008), Ji et al. (2010) highlight the lack of research which is conducted into this area. This study confirms this dearth of studies, with only 2 articles focussing on UX and 42 quotes discussing the topic. Future research should pay particular attention to this area, especially as a good experience of using technology can have a significant impact on user acceptance.

One area which is often referred to in the context of UX is choice of colour. In contrast to other areas of this study, the choice of colour in relation to user experience has more recommendations than problems. It is recommended that coordinated (Jung et al., 2009), classy colours (Ji et al., 2010), with a high saturation (Jung et al., 2009; Qian & WenDao, 2012) are used within the interface. The only problem which was identified within the literature in relation to colours is the lack of comfort which can be caused by bright colours (Ali et al., 2013). Therefore, it is recommended that peaceful and calm colours are utilised in order to avoid this effect (Qian & WenDao, 2012; Pijukkana & Sahachaisaeree, 2012). However, over-arching the choice of colours is the need to consider the individual user preferences when designing the colour scheme (Qian & WenDao, 2012; Pijukkana & Sahachaisaeree, 2012). In a previous study Ancient, Good, Wilson, and Fitch (2013) found that older adults were contradictory in regards to the colour they wanted the system to use, often with them choosing their favourite colour. Therefore, it would be advisable to allow users to choose their colour scheme, as long as this option does not increase the complexity of the system to a point which makes it difficult to use, as previously discussed.

#### 6.4.4 User Acceptance

User acceptance can be described as person's willingness to approve and continue using technology which is newly introduced to them (K. Chen & Chan, 2011). There is conflict as to whether older people are willing to accept new technologies with some researchers finding the elderly averse to new technologies (K. Chen & Chan, 2011; Hanson, 2010; Nagle & Schmidt, 2012; Shashidhara, 2010; K. Chen & Chan, 2014), whilst others find the opposite (Wallace et al., 2013; K. Chen & Chan, 2013; Heart & Kalderon, 2013; Chou et al., 2012; Arning & Ziefle, 2009). However, there is a growing recognition that a person's acceptance of new technologies should be carefully considered in order to avoid failure of the product (K. Chen & Chan, 2014).

This section will focus on investigating some of the factors which can influence the adoption and acceptance of new technologies by older people. The topics discussed align with the most commonly researched topics found in section 6.3 and include: introduction to technology, self-image and the

home environment, the technology acceptance model attitude towards technology and training provision.

#### 6.4.4.1 Introduction to Technology

The introduction older people have to technology is a vital consideration, as a poor initial experience can often shape their adoption and acceptance of the device (Barnard et al., 2013). An example often cited is those who have been introduced to technology as part of their job prior to retirement. Research suggests that a poor introduction within the workplace can reduce adoption outside the office, result in the person taking early retirement and lead to a person actively avoiding technology (Barnard et al., 2013). In addition, it is recommended that potential users be given the opportunity to physically interact with technology before purchasing to improve levels of adoption (Gilly et al., 2012; Peeters, de Veer, van der Hoek, & Francke, 2012; Barnard et al., 2013; Wilkowska & Ziefle, 2009; Nasir et al., 2008; Braun, 2013; Hough & Kobylanski, 2009; Ryu et al., 2009; Barnard et al., 2013), allowing them to prove to themselves they are able to control the device (Leikas & Saariluoma, 2008).

Familiarity with technology is a predictor of technology adoption, with people who are lacking in this area less likely to adopt new technologies (Logue & Effken, 2012; Boontarig et al., 2012; Ji et al., 2010; Taylor et al., 2014). As a direct result of this, enthusiasm for technology is tempered (Wild et al., 2012). The lack of familiarity will be particularly detrimental to older people when unfamiliar metaphors and graphical user interface elements are utilised (van Veldhoven et al., 2008; Granata et al., 2013). It can, therefore, be recommended that utilising existing interface design elements and mental models can “enhance the discovery process” (Higgins & Glasgow, 2012). Additionally, if older people have already adopted one technology, bundling new devices with existing products could improve the acceptance (Young, Willis, Cameron, & Geana, 2014). It has also been shown that regular use may improve the prospect of technology being integrated into everyday life (Patomella et al., 2011; Braun, 2013).

As a result of the era older people grew up in, they will often have very limited exposure to modern technologies (K. Chen & Chan, 2013; O’Brien et al., 2013; Barnard et al., 2013; Greengard, 2009; Ziefle, 2010; Hart et al., 2008; Calero Valdez et al., 2009; Boontarig et al., 2012). An implication of this is a lack of experience in computing (M.-Y. Hwang et al., 2009, 2011; Taveira & Choi, 2009; Ji et al., 2010; Schneider, Schreiber, Wilkes, Grandt, & Schlick, 2008; Hakkarainen, 2012; Mertens et al., 2012; Or & Tao, 2012; J. Zhou et al., 2012; Castilla et al., 2013; Arning & Ziefle, 2009), which can limit a person’s enjoyment of technology (Gatto & Tak, 2008). Through increasing the usability and dependency of the technology, it is suggested that this lack of experience can be counteracted (M.-Y. Hwang et al., 2011). Additionally, the use of common or known activities has the potential to eliminate the need for experience in using computers (Meza-Kubo & Moran, 2013), as the paradigms utilised are

not specific to technology.

A limited understanding and knowledge of computers reduces an older person's motivation to start using technologies (K. Chen & Chan, 2014, 2013; M.-Y. Hwang et al., 2011; Arning & Ziefle, 2009; Xue et al., 2012; Calero Valdez et al., 2009; Patomella et al., 2011). This leads to a lack of interest (Boontarig et al., 2012) and can deter the use of technologies which are designed to support older adults (K. Chen & Chan, 2014). Enthusiasm for technology can be tempered due to a fear of breaking the device (Barnard et al., 2013; Nasmith & Parkinson, 2008; Nijhof, Gemert-Pijnen, Burns, & Seydel, 2013; Ji et al., 2010; Greengard, 2009), the possibility of losing work (Dickinson et al., 2011), and being unsure of what to do when mistakes or errors occur (Barnard et al., 2013; K. Chen & Chan, 2014). To mitigate the effect of this, it is suggested that older people should be supported throughout the adoption process and during times when they are unsure how to proceed (Barnard et al., 2013).

The enjoyment experienced when using a computer system was identified as one of the most important components of needs satisfaction (L. Wang et al., 2011). It is also suggested by Chou et al. (2012), that one motivation for an elderly person to adopt technology is to "enjoy creation". Once made available, technology can lead to "unanticipated enjoyment" for the older person, which could increase the likelihood of adoption (Rosenthal, 2008). Through tapping into this enjoyment and emphasising it from the moment the older person is introduced to technology, the possibility for acceptance may be enhanced. In addition, Barnard et al. (2013) found that early adopters found trying out new systems a pleasurable experience in itself, with those who are reluctant not finding any associated pleasantness. It could, therefore, be recommended that making the device inherently pleasant to use would be of benefit to the reluctant adopters.

#### **6.4.4.2 Self-Image and the Home Environment**

The use of gerontechnology can be incompatible with a person's self-image (K. Chen & Chan, 2013; Young et al., 2014), which can lead to a loss of confidence in the device (Karlsson et al., 2011). Often, older people will be concerned that the use of technologies designed for them will single them out as old (Hough & Kobylanski, 2009; Rosenberg et al., 2012; Ji et al., 2010; K. Chen & Chan, 2013; J. Zhou et al., 2012), with most believing that they do not need technology (Abdullah, Salman, Razak, Noor, & Malek, 2011), or that it brings them closer to a reduced level of independence and autonomy (Karlsson et al., 2011). In a case-study based study, Karlsson et al. (2011) found that one participant only used the technology in a manner which matched their self-image. If technology can be designed to match, support and enhance the user's self-image the device may be more readily adopted (K. Chen & Chan, 2013; Langdon & Thimbleby, 2010).

A lack of self-confidence can often hinder an older person's adoption of technology (Chou et al., 2012; Lam & Chung, 2009; M.-Y. Hwang et al., 2011, 2009; L. Wang et al., 2011; D. Williams et al., 2013;

Rosenthal, 2008; K. Chen & Chan, 2014; Czaja et al., 2013; Rosenthal, 2008). This can lead to a rejection of technology which is perceived to be too difficult for them to use (Tsai, Chang, Chang, & Huang, 2012; Wandke et al., 2012). In addition, this lack of confidence can result in feelings of helplessness, and a fear of failure (D. Williams et al., 2013; Wilkowska & Ziefle, 2009; K. Chen & Chan, 2014; Hollinworth & Hwang, 2010; Barnard et al., 2013; Nasmith & Parkinson, 2008; Nijhof et al., 2013). Confidence can be built through regular, successful interactions with technology (Wagner et al., 2010; Wild et al., 2012). It is, therefore, recommended that external support mechanisms should be provided in order to support the older person whilst their confidence is built through practice (L. Wang et al., 2011).

Older people are often resistant to the changes which may be required during the adoption of technology (Lam & Chung, 2009; J. Zhou et al., 2012; Hough & Kobylanski, 2009; K. Chen & Chan, 2013; Barnard et al., 2013; Ramón-Jerónimo et al., 2013), especially if changes to existing habits is required (Papa et al., 2012). In addition to resistance to change, modifying habits and existing paradigms can be challenging for older people (van Veldhoven et al., 2008; Vastenburg et al., 2008; K. Chen & Chan, 2013). Computers can be seen as something which is making an unwelcome entrance into their everyday life (Young et al., 2014). However, through taking advantage of existing habits (Rosenberg et al., 2012), or ensuring that new technologies do not force the user to make radical changes to their current behaviours.

The acceptance of a technology can be affected by the impact it makes on the home environment. If the device makes the home look too “institutional”, the likelihood of adoption will be significantly reduced (McKenzie, Bowen, Keys, & Bulat, 2013), especially if it is seen as belonging in a hospital (Greenhalgh et al., 2013). Therefore, technology should be designed to be un-obtrusive, so that it fits with the existing infrastructure of the home, without the requirement for older people to make modifications (Lorenz & Oppermann, 2009; McKenzie et al., 2013). Additionally, the devices which are supplied to older people should not resemble medical devices, and avoid appearing too institutional (E. L. Mahoney & Mahoney, 2010; McKenzie et al., 2013).

Technology is also seen as interfering with everyday life and current lifestyles (Greenhalgh et al., 2013; Young et al., 2014; McKenzie et al., 2013). In addition, some care-givers of PwDs believe that the technology is replacing their role, which could lead to isolation for the person being cared for (Shashidhara, 2010). Alternatively, there is a perception that the burden will shift from care-giving to the maintenance of the technology (A. S. Hwang, Truong, & Mihailidis, 2012). Therefore, it could be recommended that technologies should be designed to either complement, or align with, existing living patterns and care plans rather than forcing the users to adapt to new paradigms (Vastenburg et al., 2008; Callari, Ciairano, & Re, 2012; Greenhalgh et al., 2013).

#### 6.4.4.3 The Technology Acceptance Model

The Technology Acceptance Model (TAM) aims to demonstrate the key factors which influence adoption of new systems. These factors include: Perceived Ease of Use (PEOU), Perceived Usefulness (PU), and facilitating conditions, all of which need to be considered when developing new systems, regardless of the target demographic. In this section, both PEOU and PU will be discussed. In addition, the perceived benefit, which is inherently linked to PU, will be discussed.

One significant element of the TAM is the PEOU of the application. Often, older adults experience a lower PEOU than younger people (J. Zhou et al., 2012; Or & Tao, 2012; Money et al., 2009), which acts as a barrier to adoption (Ryu et al., 2009; Xue et al., 2012). Interfaces and interaction principles which are poorly designed, hinder the older person's perception of the ease with which the technology can be used (Kuo et al., 2012; Hakkarainen, 2012). If the PEOU is significantly low, making the device difficult to use, it can result in the potential user abandoning or not adopting the technology (Roupa et al., 2010; Barnard et al., 2013; Greengard, 2009). Through the use of appropriately designed interaction principles, which include intuitiveness, ease of use and ease of mastery, older adults can be supported through the adoption process (Lorenz & Oppermann, 2009; K. Chen & Chan, 2011; Nagle & Schmidt, 2012). In addition, to reduce the perception of difficulty, which is often associated with failure to complete tasks, interfaces should focus on ensuring that tasks are successfully completed rather than efficient (J. Zhou et al., 2012; K. Chen & Chan, 2011).

Another factor which needs to be examined when considering the acceptance of technology using the TAM model is the PU. Older people often perceive technology as useless (K. Chen & Chan, 2013; Hanson, 2010; Hakkarainen, 2012; J. Zhou et al., 2012), with them experiencing difficulties in identifying any advantages to using the new technology over and above the existing devices (van Veldhoven et al., 2008). However, if the device can clearly demonstrate that it satisfies a perceived need, the adoption rate should increase (Reeder et al., 2011; Hanson, 2010; Nasir et al., 2008; van Veldhoven et al., 2008; L. Wang et al., 2011). Additionally, there is often a mismatch between the features included in the system and the user's wants, needs, and expectations (Or & Tao, 2012), which could have a detrimental effect on the PU. Therefore, through the inclusion of potential users throughout the development process, interface designers can ensure that their expectations are met, thus, potentially improving the acceptance of the device.

It is important to clearly demonstrate to older people the potential benefits of adopting new technologies (van Veldhoven et al., 2008; Vastenburg et al., 2008; Lam & Chung, 2010; J. Zhou et al., 2012; Shashidhara, 2010; Peeters et al., 2012; Xue et al., 2012; Holzinger et al., 2010; Mitzner et al., 2010). This is particularly important as this demographic often have a lack of knowledge and understanding that these benefits exist (Hough & Kobylanski, 2009; Greengard, 2009; Rosenthal, 2008; Goodwin, 2013; Hart et al., 2008; Wagner et al., 2010; Wallace et al., 2013). In addition, older people will tend

to be more sceptical about the advantages of technology use, with them regularly believing that the marketing and media are overstating the potential benefits (Wagner et al., 2010; Gilly et al., 2012; van Veldhoven et al., 2008). A lack of perceived benefits can reduce an older person's motivation to learn to utilise new technologies which could have a positive impact on their life (Wandke et al., 2012), and are, therefore, seen as not worth adopting (Wilkowska & Ziefle, 2009; Shashidhara, 2010). In an attempt to overcome this effect, the benefits for older people adopting new technologies over existing ones should be clearly shown (Young et al., 2014; Logue & Effken, 2012). Additionally, demonstrating that the advantages outweigh the costs associated with adoption can improve the likelihood that a person will accept new technologies (J. Zhou et al., 2012).

#### 6.4.4.4 Attitude Towards Technology

The attitude a person has towards technology shapes their acceptance of the device. Those who have a bad perception of, or attitude towards, technology are less likely to adopt than those who perceive it from a more positive perspective (Hakkarainen, 2012; Wagner et al., 2010). It is suggested that older people will have "overtly" negative views in relation to computing (Hakkarainen, 2012), with the negativity increases in proportion with age (Wagner et al., 2010). However, it has become apparent that if the person can be exposed to technology regularly and successfully, these negative attitudes can be improved (Wild et al., 2012; Wagner et al., 2010).

Older people tend to have a fear of using computers (Vastenburg et al., 2008; de Sant'Anna et al., 2010; Goodwin, 2013; Hart et al., 2008; Abdullah et al., 2011), which is heightened when they are using a computer which is not their own (K. Chen & Chan, 2013). There are, however, a couple of strategies which can be implemented in order to reduce this technophobia. Through designing an interface which is easy to use and supports the user to overcome their fears of personal failure when interacting with technology (Holzinger et al., 2010; Abdullah et al., 2011; Dogruel, Joeckel, & Bowman, 2012). Additionally, if the device is developed to avoid appearing too much like a computer, the person's fear of using technology could be reduced (Vastenburg et al., 2008). Implementing these strategies has the potential to minimise feelings of technophobia, and thus, may improve the acceptance of the device.

In addition to technophobia, older people have a reduced level of comfort when interacting with technology (Heart & Kalderon, 2013; Gilly et al., 2012). This lack of comfort with technology also includes a high level of anxiety with interacting with computers (K. Chen et al., 2013; K. Chen & Chan, 2014; Ramón-Jerónimo et al., 2013; Barnard et al., 2013; Hollinworth & Hwang, 2010; Tseng et al., 2012; K. Chen & Chan, 2013; Mitzner et al., 2010; Ryu et al., 2009), leading to tension (Wild et al., 2012). This anxiety can result in low expectations of successful interaction (Hollinworth & Hwang, 2010), and an increased divide between people who can use technology and those who can't (Hakkarainen,



2012; K. Chen & Chan, 2013). It is suggested that levels of anxiety can be reduced through the use of supported interactions which aims to increase exposure to technology (Wild et al., 2012), improve satisfaction (Wagner et al., 2010), and promote performance (Wilkowska & Ziefle, 2009; Wagner et al., 2010).

#### 6.4.4.5 Training Provision

Barnard et al. (2013) suggest that the availability of training can have an impact on the acceptance of technology, a finding which has been regularly cited as a key adoption factor (Logue & Effken, 2012; Lam & Chung, 2010; Xue et al., 2012; Hernández-Encuentra et al., 2009; K. Chen & Chan, 2013). Provision of training can have a positive impact on an older person's interaction with, and acceptance of, technology (Czaja et al., 2013; Wild et al., 2012). These benefits include: a reduction in use of working memory (Higgins & Glasgow, 2012), improved self-efficacy (Logue & Effken, 2012; Czaja et al., 2013; Wagner et al., 2010), and increased task performance (Czaja et al., 2013). However, despite its importance, there is a lack of support (Pan & Jordan-Marsh, 2010; Hakkarainen, 2012) and training provision (Matlabi, Parker, & McKee, 2012; Pan & Jordan-Marsh, 2010). To help older people to overcome the barriers they often experience with technology, it is recommended that appropriate training is implemented (J. Zhou et al., 2012; Taylor et al., 2014; M.-Y. Hwang et al., 2011; Santa-Rosa & Fernandes, 2012; Heart & Kalderon, 2013), which supports the wide variety of needs associated with this demographic (Reeder et al., 2011; Goodwin, 2013). In addition, any support which is provided to older people should be readily available (L. Wang et al., 2011), and in particular circumstances, should be immediate (Nagle & Schmidt, 2012). Where there is a support provision, it is often insufficient for the needs of the elderly (Rosenthal, 2008). Therefore, not only should the provided support be timely, it should also be adequate for the intended users (Wilkowska & Ziefle, 2009; Wagner et al., 2010; Rosenthal, 2008; J. Zhou et al., 2012).

Due to the impairments associated with older age, it can take longer for elderly people to learn to use new technologies (Charness & Boot, 2009; Gatto & Tak, 2008). Additionally, they tend to be more reluctant to expend the required energy in order to learn (Hanson, 2010; Shashidhara, 2010). The length of time it takes to learn a new technology will be especially important for the informal care-givers of PwDs, whose time is extremely limited due to their caring duties. Therefore, any systems which are developed for older adults should reduce the time-cost of learning, particularly for those who have caring roles.

Learning success can be dependent on the quality of the tutor (K. Chen & Chan, 2013). Older people tend to find that younger people are more impatient when trying to explain the operation of technologies (Pan & Jordan-Marsh, 2010; K. Chen & Chan, 2013). This effect could be due to a lack of understanding about the special needs that the elderly require when interacting with computing devices

(Pan & Jordan-Marsh, 2010). Additionally, the rate in which training is provided is often too fast for older learners (Nijhof et al., 2013; K. Chen & Chan, 2013). The training provision could be improved by slowing down the rate of teaching (Pan & Jordan-Marsh, 2010; J. Zhou et al., 2012; K. Chen & Chan, 2013), accepting progress may be slow (Barnard et al., 2013), and increasing the tutor's patience level (K. Chen & Chan, 2013; Goodwin, 2013; Pan & Jordan-Marsh, 2010). In addition, small classes which create a favourable environment and provide in-depth tutorials can help older people to learn how to use technology (J. Zhou et al., 2012; D. Williams et al., 2013; K. Chen & Chan, 2014). Finally, the use of peer learning has the potential for elderly people to be supported through the learning process by a person with a higher level of understanding with regard to the challenges they are facing (Pan & Jordan-Marsh, 2010).

As an alternative tool for learning, older people can turn to manuals and automatic tutorials. However, these learning methods are often too technical for the elderly to understand (J. Zhou et al., 2012; Lam & Chung, 2010). In the case of automatic tutorials, it has been found that providing interaction support before the task needs to be carried out can be confusing for older people (Reeder et al., 2011). The use of tutorials prior to execution of the task will particularly challenging for PwDs, as a reduction in short term memory abilities may result in them forgetting key information required to complete the activity. These automatic tutorials can also cause frustration when the task involved is easier to complete than normal interactions with the system (Reeder et al., 2011). Therefore, Reeder et al. (2011) suggest that any automatic tutorials provided should be appropriate to the system, with them including actual tasks involved in interacting with the technology. In addition, any manuals provided to the users should include simple, easy to follow, and appropriate step-by-step instructions relating to the system (J. Zhou et al., 2012; Barnard et al., 2013; Higgins & Glasgow, 2012; J. Zhou et al., 2012; Lam & Chung, 2010; Santa-Rosa & Fernandes, 2012).

## 6.5 Conclusion

This chapter has discussed the results of a study which was conducted in order to establish a set of guidelines which should be followed when developing interfaces for PwDs. In addition to the needs associated with the dementia, the natural ageing process should be considered. In addition to accessibility, usability and UX, the acceptance of technology has been considered. Based on the grounded coding of the quotes obtained during the secondary research and a synthesis of the literature, the following guidelines were developed:

1. Provide a system which is user-paced
2. Encourage interface simplicity and minimise complexity
3. Develop an easy-to-use system, which takes into account the possible impairments experienced

4. Provide an interaction which aims to be intuitive, but with provision for training and post-adoption support
5. Provide options for interface customisation
6. Where possible, avoid the use of hierarchical navigation structures
7. Enhance available resources, whilst supporting those which have declined
8. Demonstrate usefulness and benefit to the users
9. Choose input and output modalities appropriate to the users and the tasks to be performed
10. Provide support to adopt new technologies
11. Ensure the introduction to technology is appropriate to the person, their self-image, and the task to be carried out

Table 6.2 summarises how the information gained during the literature synthesis relates to the guidelines listed above.

The study presented in this chapter has a limitation in that the articles gathered were restrictive. Due to the large amount of literature associated with interaction needs of older people, it was decided to approach this study as an ongoing process. The results presented in this chapter discuss the first stage of the guideline development. Therefore, these guidelines only incorporate the findings of studies which investigated interaction needs. Future research will evolve the guidelines to include research which focus on other areas, but do draw conclusions on interaction. Subsequent research will also involve article snowballing, aiming to build towards a definitive set of guidelines which can be followed when developing interfaces for PwDs and older people.

These guidelines will be utilised when implementing the theory-based reminiscence program on a tablet device. However, it is important to highlight that there are many gaps within the literature which need to be address, particularly the lack of recommendations for the established problems, and a deficit in the information regarding the experience created when using technologies.

Table 6.2: Summary of the application of the guidelines to interaction design domains

Guidelines	Challenge Overcome			
	<b>Accessibility</b>	<b>Usability</b>	<b>UX</b>	<b>User Acceptance</b>
Provide a system which is user-paced	<ul style="list-style-type: none"> <li>- Decline in dexterity</li> <li>- Decline in muscle strength</li> <li>- Reduced processing speed</li> <li>- Reduced learning speed</li> </ul>	<ul style="list-style-type: none"> <li>- Decline in task performance</li> </ul>		
Encourage interface simplicity and minimise complexity	<ul style="list-style-type: none"> <li>- Decline in working memory</li> <li>- Decline in the ability to inhibit irrelevant information</li> <li>- Reduced learning speed</li> </ul>	<ul style="list-style-type: none"> <li>- Need simplified interaction</li> <li>- Poorer search performance</li> <li>- Lack of familiarity with technology</li> <li>- Reduced performance, due to complexity</li> <li>- Difficulty managing complex interactions</li> <li>- Decline in task performance</li> <li>- Too many functions and features</li> </ul>		<ul style="list-style-type: none"> <li>- Reduced PEOU</li> <li>- Lack of familiarity with technology</li> </ul>

Develop an easy-to-use system, which takes into account the possible impairments experienced	<ul style="list-style-type: none"> <li>- Motor impairments</li> <li>- Cognitive impairments</li> <li>- Visual impairments</li> <li>- Auditory impairments</li> </ul>	<ul style="list-style-type: none"> <li>- Need interfaces to be easy to use</li> <li>- Need interfaces to be easy to understand</li> <li>- Lack of familiarity with technology</li> </ul>		<ul style="list-style-type: none"> <li>- Reduced PEOU</li> <li>- Lack of familiarity with technology</li> </ul>
Provide an interaction which aims to be intuitive, but with provision for training and post-adoption support	<ul style="list-style-type: none"> <li>- Reduced learning speed</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of familiarity with technology</li> <li>- Difficulties with navigation</li> </ul>		<ul style="list-style-type: none"> <li>- Reduced PEOU</li> <li>- Lack of familiarity with technology</li> <li>- Poor training provision</li> <li>- Reduced exposure to technology</li> </ul>
Provide options for interface customisation	<ul style="list-style-type: none"> <li>- Large differentiation between older users</li> <li>- Visual impairments</li> <li>- Auditory impairments</li> </ul>	<ul style="list-style-type: none"> <li>- Reduced readability, due to font sizes</li> </ul>	<ul style="list-style-type: none"> <li>- The need to consider user preferences</li> </ul>	

Where possible, avoid the use of hierarchical navigation structures		- Difficulties with navigation		
Enhance available resources, whilst supporting those which have declined		- Decline in task performance  - Difficulties with navigation		
Demonstrate usefulness and benefit to the users				- Skeptical about benefits of technology - Increased resistance to change - Reduced PEOU - Reduced PU
Choose input and output modalities appropriate to the users and the tasks to be performed	- Motor impairments  - Visual impairments	- Input and output inappropriate for the task to be performed  - Small device form factor		- Devices which do not fit with self-image  - Devices which do not fit with home environment

Provide support to adopt new technologies		<ul style="list-style-type: none"> <li>- Lack of familiarity with technology</li> <li>- Inappropriate help functionality</li> </ul>		<ul style="list-style-type: none"> <li>- Poor introduction to technology</li> <li>- Negative attitude to technology</li> <li>- Technophobia</li> <li>- Reduced comfort levels</li> <li>- Reduced availability of appropriate support and training</li> </ul>
Ensure the introduction to technology is appropriate to the person, their self-image, and the task to be carried out.				<ul style="list-style-type: none"> <li>- Introduction to technology</li> <li>- Self-image of the person</li> </ul>

## CHAPTER

# 7

# THE DESIGN AND EVALUATION OF A THEORY-BASED REMINISCENCE APPLICATION

## 7.1 Introduction

The final part of this research project developed and evaluated the acceptance of the reminiscence program. The findings from the previous two studies were incorporated within a positive reminiscence based application which was facilitated using tablet computers. The application makes use of photograph, music and story stimuli, which earlier research within this thesis have suggested are potentially the most effective memory prompts (see chapter 5). In addition, the application uses personalised memories, rather than generic ones, in order to evoke stronger positive emotions for the person reminiscing. The interface developed during this study will be built from the interaction guidelines which were established as part of the previous study.

The studies contained within this chapter aim to develop and assess the acceptance an application which can facilitate positive reminiscence based on the findings contained within chapters 5 and 6 of this thesis. Prior to considering the process of developing and evaluating, existing implementations of technology-supported reminiscence programs will be discussed.



### 7.1.1 Existing Technologies to Support Reminiscence

There have been a number of studies conducted which investigate the use of technology to facilitate reminiscence, which have been previously reviewed in Lazar, Thompson, and Demiris (2014). This section will not seek to replicate the the process conducted within the systematic review conducted by Lazar et al. (2014), however, it will highlight a few projects which are related to the outcomes of this project. It will discuss, the Computer Interactive Reminiscence and Conversation Aid (CIRCA) project, conducted in Dundee; lifelogging; the Alive! project; and the Computer Assisted Reminiscence Therapy (CART) project. Finally, this section will summarise the gaps within the existing literature which this project will aim to rectify.

#### 7.1.1.1 The Computer Interactive Reminiscence and Conversation Aid Project

Research carried out at the Universities of Dundee and St. Andrews aimed to implement reminiscence therapy using a desktop touch screen environment as a cognitive prosthesis (Alm et al., 2004). CIRCA utilised generic memory prompts in order to elicit conversation between PwDs living within residential care, and their care-givers.

The researchers behind the CIRCA project comprised of a multi-disciplinary team, including a psychologist, graphic designer, and software engineer (Gowans et al., 2004). The team utilised an iterative design methodology to develop the application. This allowed the researchers to produce a well-developed program at each iteration, and incorporate resolutions to the issues which were identified by users in the previous version (Alm et al., 2007). In addition, this aligns with research discussed earlier which suggested that older people should not be exposed to partially developed systems (Karlsson et al., 2011).

A significant design feature of the CIRCA system was the failure safe system (Alm et al., 2004). This was highlighted by the researchers as a crucial element which had to be included. The PwDs were provided the opportunity to interact within a system which they could not choose the wrong option (Alm et al., 2004; A. J. Astell et al., 2010). Further research found that the care-givers, who in traditional reminiscence sessions were required to maintain the conversation, were able to relax and allow the PwD to take the lead (A. J. Astell et al., 2010). They found that the atmosphere created was “much more relaxed” as a direct result of interaction with the technology (Gowans et al., 2004).

The generic prompts utilised were based on the area local to the participants, with an emphasis on both Dundee and Scotland (Alm et al., 2007). Whilst this would be extremely useful for people who have grown up in the area, for those who have moved into the area, it would not be as effective. Whilst the research did show increased engagement with the device (Gowans et al., 2004; Alm et al., 2004; A. Astell et al., 2008), the use of personalised prompts might have increased the interaction further

as discussed by Cohen-Mansfield, Thein, et al. (2010) and Mulvenna et al. (2011). The researchers justify their decision to omit this option by stating the use of personal memories “led to distress” (Alm et al., 2007). However, Azcurra (2012) suggests that “no harmful events were identified” during the reminiscence therapy session, implying that these distressing moments are rare. It would be impossible to guarantee that no ill effects will be experienced, however, Woods et al. (2005) suggest that measures should be implemented to mitigate negative responses to stimuli. In an attempt to minimise the likelihood of this occurrence, Ancient et al. (2013) used pop-up notes to scaffold the interaction and provide additional prompts to remind the person with dementia of the contents of the reminiscence item.

#### **7.1.1.2 Lifelogging**

Lifelogging utilises wearable technologies to produce a “digital archive” of a person’s daily interactions (Whittaker et al., 2012; Sellen & Whittaker, 2010). There are two types of lifelogging: total capture, and situation-specific capture. Total capture involves a camera which takes regular images throughout the day, in some cases, one every 30 seconds (Sellen & Whittaker, 2010). In contrast, situation-specific capture will only take photographs when particular conditions are met (Sellen & Whittaker, 2010). From a reminiscence perspective, the situation-specific capture would be more applicable. However, whilst lifelogging has the potential to be useful for PwDs in the future, for the current generation it would be inappropriate, as it would not evoke memories which are stored in the long-term memory.

#### **7.1.1.3 The Alive! Project**

Research conducted by the University of Worcester as part of the Alive! project (T. Jones, Kay, Upton, & Upton, 2013) established the potential for an iPad to have a positive impact when used to recall elements of a person’s history. However, the focus of the study was to evaluate the use of iPads in general, rather than with a specific application to reminiscence. In addition, no dedicated application was used to store these personal recollections, and there was limited consideration as to the types of stimuli together with the effectiveness of the prompt.

#### **7.1.1.4 The Computer Assisted Reminiscence Therapy project**

The CART project built on the research conducted as part of CIRCA, applying both generic and personalised reminiscence to a tablet computer (Pringle & Somerville, 2013). This eliminated the problem of lack of portability associated with the CIRCA project. Pringle and Somerville (2013) found that using the technology-supported reminiscence engaged the PwDs, expanded conversation topics, and improved their ability to recall information about the memory prompt. This project does demonstrate that it is possible to implement reminiscence on a tablet device, with positive outcomes for the PwD.

However, the research was again conducted within the residential care home environment. In addition, there is no consideration for the effect that it has on the care-giver and relatives of the PwD.

#### **7.1.1.5 Gap in Reminiscence Applications**

Whilst a number of research projects investigating the use of technology to facilitate reminiscence have been conducted, the research conducted and discussed within this chapter does make a contribution to knowledge.

Most of the dementia-related research projects discussed in this section have implemented reminiscence therapy using touch-screen devices; however, these studies were carried out within the residential care environment. With two-thirds of people living with dementia being cared for within the community (Alzheimer's Society, 2013), it is important to try and provide other solutions. Technological solutions for use within the home environment offer one potential solution.

Home-based interventions have the potential to allow reminiscence therapy to be personalised to the participants and make it available at the point of need. Additionally, it will allow the process to be a continual programme which has the future potential to increase the quality of life of people experiencing dementia, in accordance with the findings of Sharif et al. (2010). There doesn't appear to be a theory-based implementation a reminiscence program using a tablet computer for use within the home environment. Whilst there exists an application called iReminisce which is tablet-based, it lacks a grounding in research. This research project has used a theory-based approach to develop a reminiscence program which is implemented on a tablet device. This will aim to support the engagement of PwDs and their care-givers in reminiscence activities within the home environment.

The research carried out by the Universities of Dundee and St. Andrews presents interesting findings in relation to the use of a touch-screen computer for reminiscence. However, the memories used were generic to the area in which the research was conducted. Whilst this would be beneficial to those who know the area, for PwDs who are living outside this area and those who have no knowledge of the area, they will might not be very useful. This research will build on the finding that technology-supported reminiscence is beneficial to older users, and enhance it to make the memory prompts more specific to the person who is engaging in the activity.

### **7.1.2 Chapter Structure**

This chapter will discuss the findings of the final two studies within this research project. Firstly, it will discuss the methods used throughout the two studies. The results section will include the outcomes of the participatory design sessions, the interface design, and an analysis of the content analysis from a quantitative perspective. Finally, a discussion of the qualitative data gained throughout the focus

groups and interviews conducted.

## 7.2 Method

Initially, the contents of this chapter were split into 2 studies: one to develop the application and one to provide an extended test period. Initially, the aim of the second study was to test the effectiveness of the application with respect to improving the well-being of people living with dementia and their care-givers, using a control group. However, due to the small sample size, the results from this study could not be determined as significant. At this point, it was decided to change the focus to investigate the potential for acceptance of the device instead.

The aim of the application development study was to utilise participatory design techniques in order to produce a reminiscence program supported through technology which has a user-centred interface.

### 7.2.1 Design

The application development study was split into four main sections: the exploratory phase, the high-fidelity prototype phase, software development, and beta testing. With the exception of the software development stage, PwDs and their care-givers were included at each phase of the study. The process followed during the software development phase will not be discussed within this chapter. However, the design of the application will be discussed during section 7.3.2. Upon completion of the beta test phase, an application acceptance study was conducted. All focus group sessions commenced with a cup of tea or coffee, and biscuits were provided throughout. This aimed to ensure the participants felt as relaxed as they could, and attempted to encourage them to feel comfortable with sharing their opinions in a less formal environment. The following subsections will discuss the design of each stage of both studies.

#### 7.2.1.1 Exploratory Focus Group

The exploratory phase utilised a focus group to validate the findings of the two earlier studies and assess requirements for a system which is designed to implement a positive reminiscence program. The focus group followed a semi-structured approach, with questions designed to elicit the required information, but with the flexibility for the researcher to ask additional questions if needed. The guiding list of questions can be found in appendix D.1. This focus group lasted one hour, and consisted of two PwDs, two care-givers, and a DSW (more details on the participants can be found in section 7.2.2).

### 7.2.1.2 Prototype Focus Group

Focus groups were also utilised during the prototype phase. Previous research has suggested that older adults struggle when presented with new technologies in an abstract way (Ancient et al., 2013). Therefore, it was decided that low fidelity prototypes would be inappropriate for use in this context. To avoid exposing the PwDs to an incomplete system, and therefore reduce the likelihood of future adoption (Karlsson et al., 2011), the prototypes were designed to function as the final system would. During this focus group, participants were provided with two prototypes on the tablet and asked to interact with the system. In addition, a couple of memories were added prior to the session to allow them to start wherever they wanted in the system. There were no specific tasks provided, but participants were given a grid to complete, which included boxes to fill in based on the following headings: I like; I dislike; I would add; and I would remove. It was designed to elicit their likes and dislikes for both the prototypes. The prototyping focus group consisted of one PwD, one care-giver, and a DSW (for further details see section 7.2.2). The prototyping session lasted for one hour.

### 7.2.1.3 Beta Testing Focus Group

The final stage of the application development study was the extended beta testing. During this phase participants were provided with a tablet computer to use the developed application within the home environment for a period of one week. Research suggests that help functionality is vital for older people (Chun & Patterson, 2012b; M.-Y. Hwang et al., 2011; Taveira & Choi, 2009; Arning & Ziefle, 2009). In addition, the help functionality provided is often inadequate for the demographic (L. Wang et al., 2011; J. Zhou et al., 2012; O'Brien et al., 2013; Chun & Patterson, 2012b; Dickinson et al., 2011). Therefore, as part of the beta testing phase, participants were provided with a headed sheet of paper to record the help they required. This would allow for the in-app help functionality to be appropriate to the needs of the potential users. After the week had been completed, participants took part in a focus group to share their experience of using the application. The post-beta testing focus group lasted one hour and followed a semi-structured approach. Utilising this type of method allowed for additional probing when required, based on the information gained by the researcher during the session (questions can be found in appendix D.3.1). In total five participants were included within this study: two PwDs, two care-givers, and a DSW (further details regarding the participants can be found in section 7.2.2).

### 7.2.1.4 Application Acceptance Study

During the application acceptance study, 2 sets of participants, consisting of a PwD and their care-giver were given a tablet computer to allow them to use the application within the home environment for a period of eight weeks. It was planned to conduct a focus group after this period to allow the

participants to feedback their experiences and opinions on the system. However, due to scheduling conflicts, it was decided to switch to a semi-structured interview method, the guiding questions for which can be found in appendix D.4. Each interview lasted 30 minutes, and was conducted in the presence of a DSW.

### 7.2.2 Participants

Participants were invited to take part in this research in couples, consisting of a PwD and their partner, who also has the role of informal care-giver. Both the Exploratory Focus Group (EFG) and Beta Test Focus Group (BTFG) contained two couples. Two couples were invited to participate in the Prototype Focus Group (PFG). However, due to illness one couple was unable to attend, therefore, this focus group only contained one couple. The EFG and PFG also had a DSW, who provided their expert opinion on the application based on their professional and personal experience of dementia. The application acceptance study included two couples were provided with a tablet for the duration of the eight week study.

It was originally intended that more participants would be included within each focus group, and participants were recruited accordingly. However, it was unknown to the researcher that an additional form (see appendix A.3.3.2) was required prior to approaching potential participants. As a direct result, a number of participants withdrew due to illness and progression of the condition.

### 7.2.3 Materials

All the focus groups and interviews were recorded and transcribed by the principal researcher. During the beta and extended testing phases, participants were provided with tablet computers to borrow for use of the application within the home environment.

### 7.2.4 Data Analysis

Upon transcription, all the focus groups and interviews were subjected to a content analysis. Each relevant quote was coded using a main code and a subcode. Initially, the main code was to be one of three options, based on the aim of the exploratory research: reminiscence, technology, and reminiscence technology. However, during the coding it became apparent that there was a fourth code: personal memories. The act of discussing reminiscence lead to the participants engaging in the activity themselves. The subcode were developed from a grounded perspective, whereby the codes evolved from the data.

## 7.3 Results

The following section will discuss the results obtained from the focus groups and interviews conducted as part of these studies. Initially, the results of the participatory design aspect will be discussed. Secondly, the development of the application interface will be explored, with a particular focus on the alignment with the guidelines produced within chapter 6. Finally, the results of the content analysis will be discussed. Due to their qualitative nature, these studies did result in a rich amount of data, which is discussed in section 7.4.

### 7.3.1 Participatory Design

The participatory design section discusses the results of the sessions which aimed to develop the application. During these sessions potential users were provided the opportunity to be involved in the process of developing the application to fit with their needs, requirements, and preferences. As detailed in the Method section (7.2), this involvement was facilitated through the use of focus groups. In the following sections, the results of each focus group will be discussed.

#### 7.3.1.1 Exploratory Focus Group

The EFG highlighted that the participants needed a trigger to reminiscence, rather than making an active decision to engage in thinking of the past. This suggests that not only do people need a stimulus to evoke the memory, they might also need to be prompted to use the application itself. Through effective introduction of the application as a leisure activity, participants may become more likely to adopt the technology, and integrate it into daily life, thus, providing it's own prompt to be used.

When looking at the time in which the participants discussed the various types of stimuli, the longest amount of time was spent on photographs. This suggests that it may be the optimal stimulus for older people when engaging in reminiscence activities, a finding which was also concluded within the first study conducted as part of this thesis (see chapter 5 for further details).

An issue highlighted by the participants was the need to obtain memory prompts in a timely manner. They commented that, previously, it was difficult to obtain the required stimuli at the time in which it would be most useful. Through providing them within an environment which was accessible at the point of need, the reminiscence process could be enhanced. A technology-based solution has the potential to resolve this issue, allowing users to enter many memories, within a compact device, which is portable and thus, making the stimuli available at the point of need.

From a technology perspective, the users commented that they got particularly frustrated when observing that their grandchildren had less problems with computer interaction than they did. However, they

did suggest that the solution to this would be to provide a system which is easy to use, thus reducing the inferiority felt when interacting with computers. In addition, there was concern that often when new devices were implemented, a totally new interaction technique was required, resulting in the need to “relearn everything”. Through applying guidelines 2, 3, and 4 (as detailed in chapter 6), which in summary relates to an easy to use and intuitive interface, these concerns could be alleviated.

Finally, prior to the EFG, the application did not have an appropriate name. During the session a number of suggestions were made, including: “Don’t Forget”, “Reminisce”, “Recall”, and “Memories”. On balance, the name “Don’t Forget” would be inappropriate to be used for this application, as it has the potential to go against the self image of the PwD, which contradicts guideline 11, as developed in chapter 6. Overall, it was decided that “Memories” would be the most appropriate name, as it provides an overview of the purpose of the application (to store memories), and does not interfere with the person’s self-image.

### 7.3.1.2 Prototype Focus Group

During the prototyping session, participants were asked to complete a grid which aimed to elicit the elements which were liked, those which were disliked, items which would be added to the interface, and things to be removed. Whilst the completed grids can be found in appendix D.2, the following highlights key points and how they were implemented.

The main issue highlighted whilst completing the PFG was the time-out associated with the tablet. This caused an unfortunate problem, in that the music was paused mid-song at the point that the tablet went into “sleep” mode. This issue was fixed prior to the commencement of the beta-testing phase. The application was modified to prevent the device entering “sleep” mode during operation. This was local to the application rather than global to the device, eliminating the need for the users to find the correct setting within the device to prevent this issue occurring.

In addition, within the horizontal orientation prototype, the potential users found that they were unable to see the content they were typing, as the keyboard was blocking the text box. This caused some frustration, as they were unable to check they were typing correctly until after clicking out of the keyboard. To rectify this issue, another screen was added to allow users to type their content, then return to the add memory entry. This allowed the users to see what they were typing. Once clicking on the “OK” button to enter the relevant text into the correct field, the users were returned to the previous screen. The text was added as a preview next to the button which provides the functionality for them to edit their entry.

Whilst the vertical orientation allowed the users to see the text they were typing, they actually preferred the horizontal prototype. This was mainly attributed to the increased clarity on the keyboard, as it was larger in size. The participants decided that, providing the issue relating to seeing their typing



on-screen was resolved, they would prefer to have the interface in a horizontal orientation. In order to eliminate disorientation caused by the screen changing direction, it was decided to lock the screen so that it could only be viewed in a horizontal manner.

### 7.3.1.3 Beta Testing Focus Group

A number of problems were identified and resolved during the beta testing phase. This section aims to discuss a couple of them, and demonstrate how they were resolved.

The participants who added music to the application found a significant bug within the volume controls. Once it hit the maximum level, the sound turned off, until they returned the number back down to the loudest level that the tablet supported. This issue caused some concern and, with more anxious users, has the potential to cause distress and fear that the tablet has been broken through trying to increase the volume too much. The application was modified so that once the maximum or minimum volume level had been reached, no further changes were actioned, thus eliminating the issue.

One participant experienced difficulties when using the application to take a photograph. Whilst both couples commented that the use of the on-board camera and microphone was good, an issue arose relating to the orientation of images. The participant took a photograph orienting the screen such that the image was portrait rather than landscape. However, upon adding the image, the application rotated the image into the wrong orientation, with no means of the user correcting this. It was, therefore, decided that memories based on photographic stimuli required buttons to allow the user to rotate the image to the correct orientation. This resolved the issue encountered by the participant.

In early versions of the application, users were unable to delete memories from the system. This was implemented to avoid accidental and irreversible deletion of memories from the system. However, the participants commented that they wanted the ability to permanently remove memories, particularly those which were incorrectly added. This was also mentioned during the prototyping session. Therefore, it was decided to implement the delete functionality for the extended testing period.

Despite the issues which arose as a result of bugs and omissions within the application, a positive result was gained as part of the beta testing process. One care-giver asked their partner whether she would want to continue using the application, with the answer being "yes". This is a positive outcome from the beta testing and suggested potential for a similar result in the extended testing period.

## 7.3.2 Application Design

As part of this research, an application was designed to present a vehicle to demonstrate the potential acceptance of a technology-supported reminiscence program. This application was called "Memories", a name which was chosen by the attendees of the EFG. The following section focusses on the application.

Firstly, it will describe the features and functionality of the application. Secondly, the design of the interface is considered, with a particular focus on how the guidelines developed in chapter 6 have been applied. Finally, two personas (a PwD and a care-giver) will be utilised to model the interaction for two of the main tasks which will be completed when using the application: adding a memory, and viewing the memories which have already been entered into the system.

### 7.3.2.1 Application Features

The following section will discuss some of the features which have been built into Memories. Firstly, it will detail the entry and editing of memories. This allows the PwD and their care-giver to enter their own personal recollections, and associated stimuli. Secondly, it will discuss the grouping of memories together through the use of optional keywords. Thirdly, it will comment on the types of memory retrieval from the database which can occur using the system. Fourth, it will comment on the randomisation aspect of the memory display. Fifth, it will discuss the ability for users to adapt both the colour scheme and the font size. Finally, it will discuss the addition of researcher logs within the application.

#### 7.3.2.1.1 Memory Entry and Editing

There are 3 main aspects to entering and editing a memory within the developed system: creating a memory, editing a memory, and hiding / deleting a memory.

Memories allows users to add three different types of stimuli: photographs, stories, and music. In addition, users are able to link two stimuli together, such as music and photographs. This will allow for dual-stimulation for the user. Each memory also has the provision to include additional notes. These notes have two purposes. Firstly, it will give the PwD an additional prompt, should they require it. Secondly, if the PwD is reminiscing with someone who is unaware of the memory, the notes would provide them with additional support to help discuss the memory further. Initially, these notes had to be called up through the use of a button. However, during the beta testing focus group, the potential users decided they wanted the notes to appear automatically. This was rectified for the final extended testing period.

Once the memory has been added, users have the opportunity to change their memories. This allows them to add any further details which are recalled as a result of the reminiscence. In addition, they can rectify any mistakes which may have been made. Buttons to allow the user to change the memories can be found both on the main menu, and on the reminiscence screen. Through including the change button on the reminiscence screen, the PwD and their care-giver can add additional details without needing to return to the main menu and remember which memory was to be edited.

In addition to the ability to change memories, users were given the opportunity to hide and unhide

memories. The reasons behind providing this functionality were two-fold. Firstly, it would allow memories which are temporarily associated with negative emotions to be hidden at the time which they are most upsetting. The memory can be unhidden and made visible during the rest of the time. Secondly, it would avoid the unrecoverable nature of using a delete command. The use of hide/unhide would allow the users to re-instate memories, whereas a delete button would not. However, during both the prototyping session and the beta testing session, the potential users voiced that they would prefer to have the option to delete memories, in addition to the hide/unhide functionality. Therefore, in the final testing version of Memories, this feature had been included.

#### *7.3.2.1.2 Keyword Grouping*

A key feature of the application, was the ability to group memories based on a keyword. For example, the PwD and their care-giver could group all their memories of their wedding day together into a "Wedding day" keyword. This would allow them to engage in reminiscence based on that one keyword, should they wish. The keywords used are user-defined, ensuring that the word used is appropriate to them, and to the purpose they want to use it for. In addition, multiple keywords can be added to a single memory.

#### *7.3.2.1.3 Reminiscence Types*

There are three main ways in which a user can view memories: all, keyword, and single. All memories allows the user to view memories which are chosen from the entire database. The keyword reminiscence only shows memories based on a keyword which has been chosen by the user. Single item reminiscence, will provide the user with a list of memories to allow them to choose a specific one. In all types of reminiscence, the hidden memories will be filtered, so that they are not presented.

#### *7.3.2.1.4 Randomisation*

Initially, when a user is reminiscing using either the all or keyword types of reminiscence, the memories included within the selection were randomised. However, during the beta testing session, the users commented that they would prefer to view the memories in a particular order. One participant commented "I think she might get used to looking at them in a certain order". It was agreed in the focus group that the ability to remove the randomisation and display the memories in a particular order would be useful. Therefore, an additional button was added to the reminiscence screen to allow the users to toggle between randomised memories, and non-randomised.

#### 7.3.2.1.5 *Font Size and Colour Choice*

In chapter 6 guidelines were developed to inform the design of interfaces. Of these guidelines number 5 requires interfaces to allow user customisation. In line with this, users were provided the opportunity to change both the colour scheme used and the font size.

Users were provided with four options in which to choose their colour scheme from. Initially, it was thought that it may be useful for users to fully customise their colour scheme. However, this would have added an extra layer of complexity, which could be detrimental to the user. Therefore, it was decided that four colours which could easily be chosen from the main menu would be appropriate to the users.

In relation to the text size, users were able to use buttons which made the text smaller and bigger. This would allow them to size the font so that it was appropriate to their individual needs, depending on their visual decline. The font change feature was available in the help pane, the notes pane, and the reminiscence screen when a story stimuli was displayed. In addition to guideline 5, this would also satisfy guideline 3, which required possible impairments to be accounted for in the design process.

#### 7.3.2.1.6 *Researcher Logs*

In addition to the regular functionality of the system, for research purposes, the user's interaction with the system was logged. Two main logs were created: memory entry, and memory recall. No personal data was collected as part of these logs, with only the type of stimuli and dates collected. The logs did not collect any information relating to the content of the memory.

The memory entry logged the number of stimuli for each memory added and their related types (photographs, stories, or music). This allowed the researcher to investigate whether there was a particular type of memory which was entered most. The entry log was used as part of the final interview process, with a discussion of the most entered type of memory. In accordance with the results found in chapter 5, the stimuli which was most entered into the application was photographs.

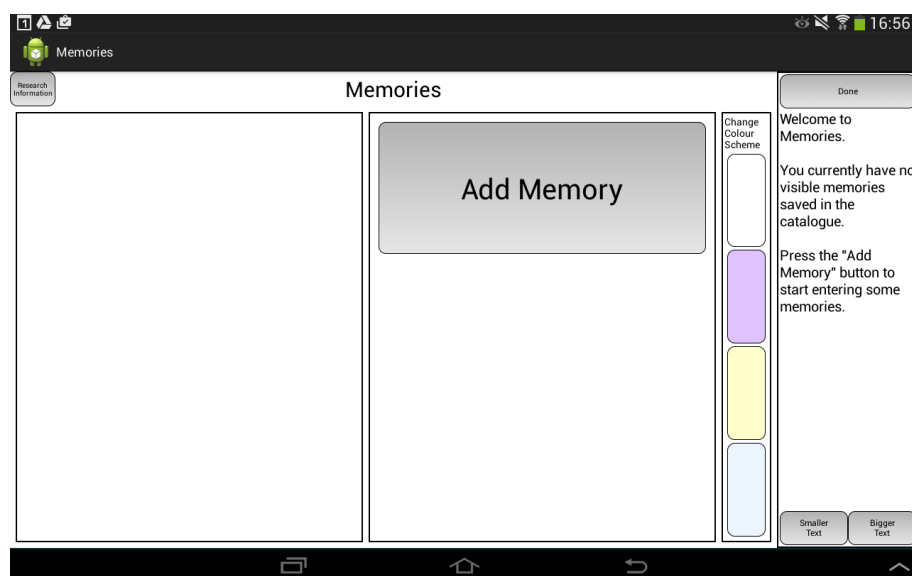
The memory recall log recorded the type of reminiscence engaged in (all, keyword, or single), the stimuli of the displayed memory and the length of time the memory was viewed. Whilst this log was not analysed as part of this research project, there is potential for future analysis to reveal whether particular stimuli was viewed more often or for a longer period of time than others.

### 7.3.2.2 **Interface Design**

The following section will discuss the interface design of the application, with a particular focus on how the guidelines developed in chapter 6 have been applied.

Guideline 1 states that the system should be user-paced. As such, there are no timed elements within the interaction with the Memories application. Therefore, users can interact with the system at their own pace. Whilst the application itself was user-paced, it was discovered during the prototyping session that the tablet “slept” after a period of inactivity. This feature of the tablet computer had not been previously considered. Therefore, it was decided to include the functionality within the application to block the tablet from “sleeping” whilst Memories was being used. Whilst this will have a detrimental effect on the battery life of the tablet, it will eliminate the frustration of constantly unlocking the tablet, and avoid the music stopping mid-track due to the tablet settings. In addition, it avoids the need for the older person to search within the settings for the time-out period, which will affect the tablet as a whole rather than locally affecting the Memories application.

Figure 7.1: Screenshot of the main menu screen when no memories have been added to the database



The screen shown in figure 7.1 demonstrates the first screen which is shown to the user upon opening the application. The only button which is visible is the “Add Memory” option. This feature had two purposes. Firstly, in alignment with guideline 4 (provide an interaction which aims to be intuitive), it guides the user to the first task they need to complete (i.e. they need to add a memory). Secondly, whilst other options do exist, in the empty state of the database, they would not function. This lack of functioning could cause frustration for the PwD.

On the right hand side of the screen shown in figure 7.1, it can be seen that the help functionality is automatically displayed upon entering the application for the first time. This applies guideline 10, which requires support provision to be provided. This help functionality includes support for users to interact with the system, and is dynamic depending on what options are available to the user (see figure 7.3). It was initially planned that the users have an active involvement in the development of the help functionality. However, in the beta testing focus group, the users stated they wanted help to be simpler

(“The simpler the better”) or a “dummies” guide. In addition to the on-screen help, the potential users wanted a “crib sheet”, which included how to operate the device together with any generic buttons which were on the tablet. It was, therefore, decided that a crib sheet should be attached to the back of the device, to avoid it being lost and ensure it was immediately available (see figure 7.2).

Figure 7.2: Image of the crib sheet attached to the back of the tablet computer

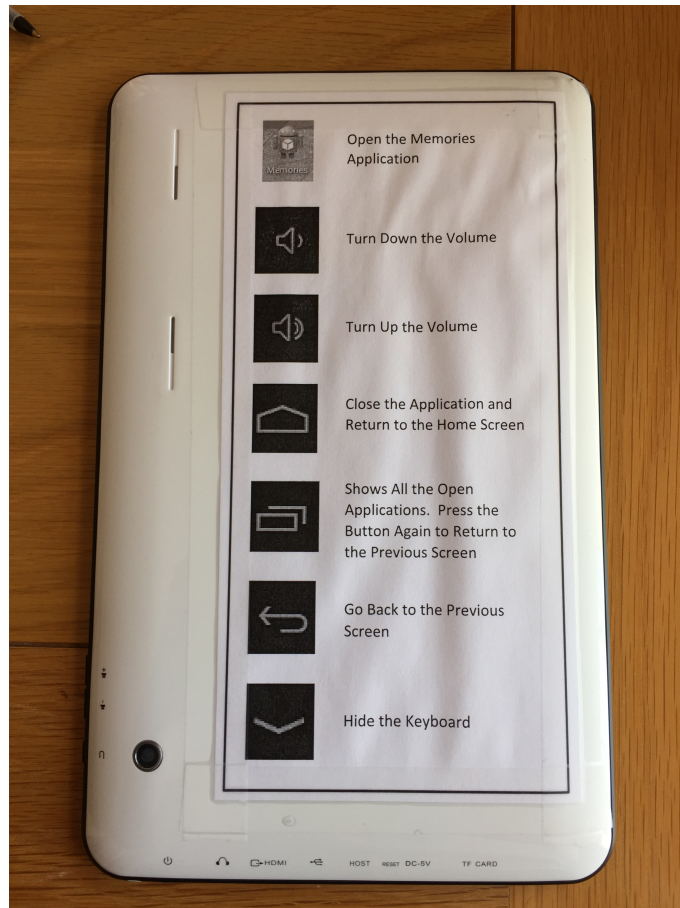
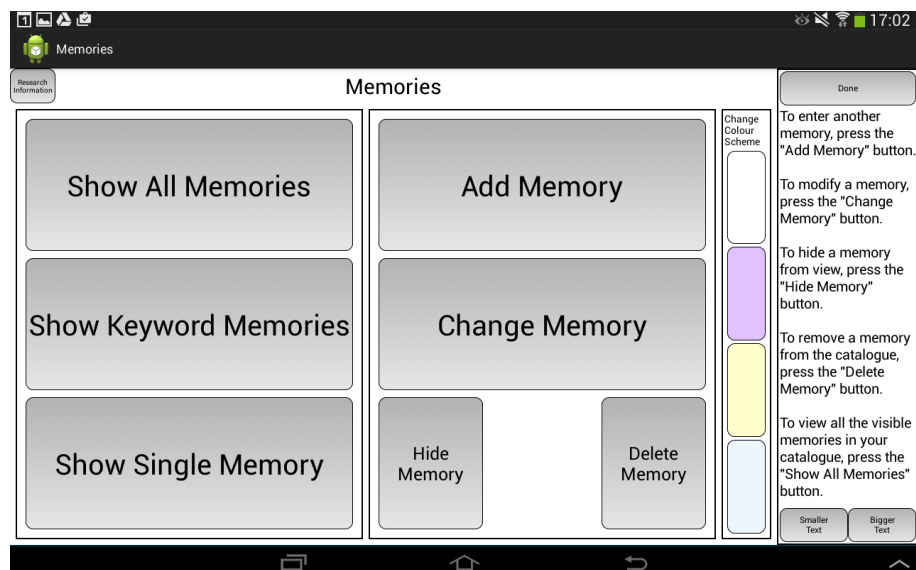


Figure 7.3: Screenshot of the main menu screen when memories have been added to the database



Once at least one memory has been added to the database, additional options will be shown, (see figure 7.3). Once again, only buttons which have functionality are shown, and as such, due to a lack of hidden memories, the “Unhide Memory” button has been made invisible. In addition, if no keywords had been added to the memory, the “Show Keyword Memories” would also be hidden.

In both the main menu screens (figures 7.1 and 7.3), the option to change the colour scheme can be seen. This aligns with guideline 5, which relates to the ability to customise the interaction, allowing the user to change the colours which are used by the interface as discussed in section 7.3.2.1.5.

Figure 7.4: Screenshot of adding a memory which uses photo stimuli

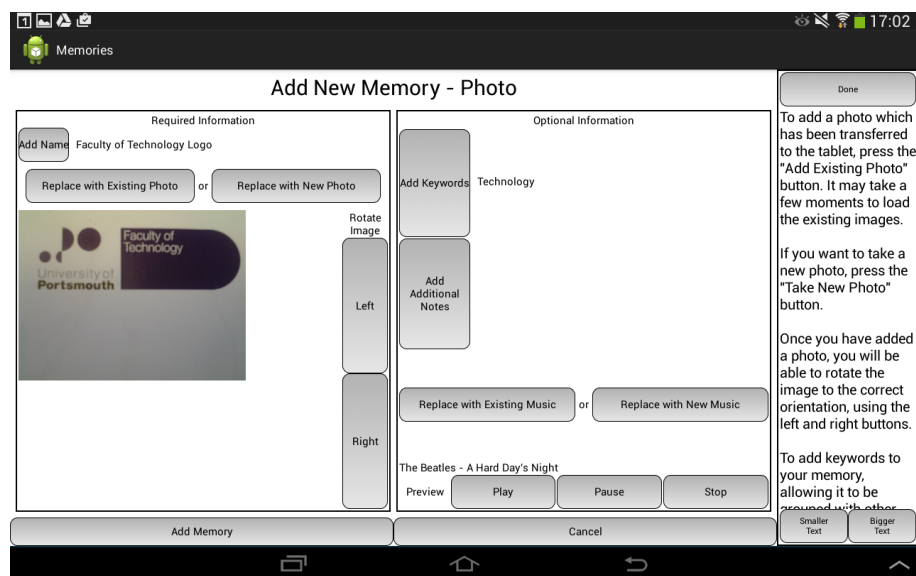


Figure 7.4 demonstrates one format of the memory entry screen, the photograph entry. Whilst the main structure of the screen remains the same, the component parts will change depending on the type of memory to be entered.

The interaction elements allows support to adopt new technologies (guideline 10), through the use of the on-board camera and microphone. Users can use the camera to upload an image of their photographs direct to the application, without the need for a computer. In addition, the users can utilise the microphone to record the music they wish to add to the memory. However, this does come at a cost. It was highlighted within the beta testing session, whereby a user found that the quality produced by the on-board camera and microphone was of a lesser quality than those transferred from the computer. This would be dependant on the device used, rather than the application. In addition, one participant intuitively rotated the tablet to take a picture, but was unable to rotate the image produced. Hence, rotate buttons were added to allow this functionality to be implemented (see figure 7.4).

Research suggests that older people struggle with using asterisks for required fields, with binary classification proving more useful (Li et al., 2012; Money et al., 2009; Sayago et al., 2010). Therefore, the add memory screens all utilise binary classification, to support the users (see figure 7.4).

A symptom often associated with dementia is short term memory loss (Alzheimer's Society, 2012). In alignment with guideline 3, there is a need to take this impairment into account when designing interfaces. Therefore, throughout the add memory screen, previews are provided to the users. For the typed elements, the entered text is displayed next to the button which is used to edit. A snapshot of the image linked to the memory is shown to the user on-screen to remind them of the photograph chosen. Finally, once music has been added to the memory, play, pause, and stop buttons are displayed to allow the user to listen to the audio. Not only does this remind the person of the stimuli they are using, but also supports the addition of memories as a reminiscence activity in it's own right.

Figure 7.5: Screenshot of viewing a memory which uses a music stimuli

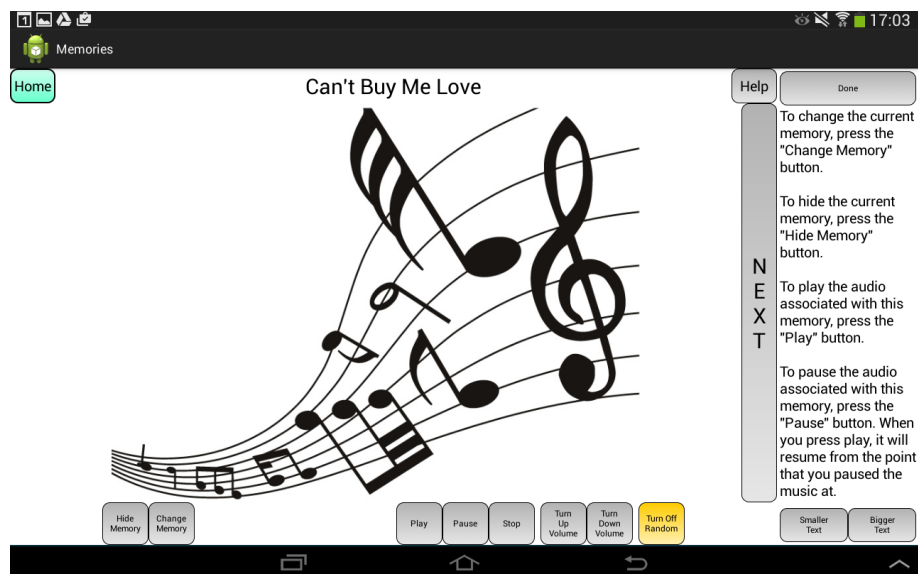
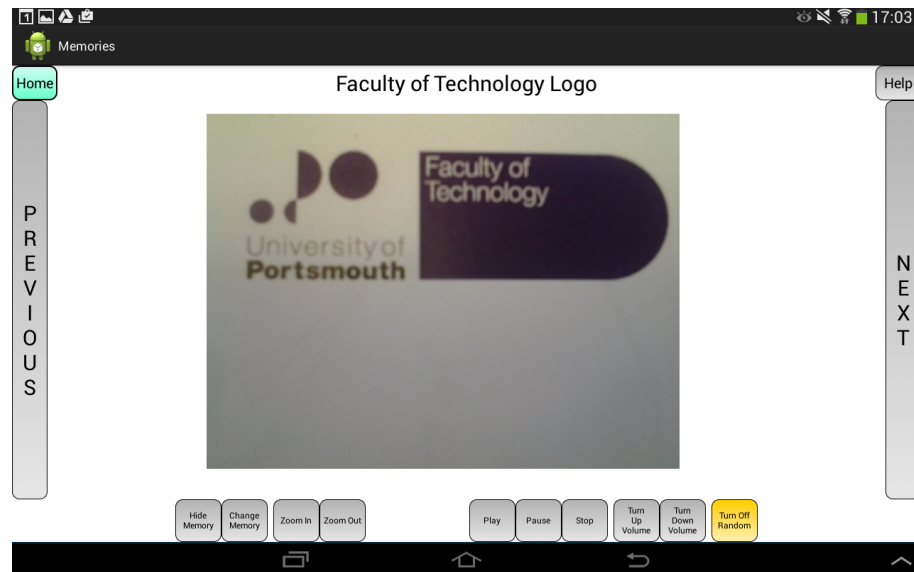




Figure 7.6: Screenshot of viewing a memory which uses both photograph and music stimuli



Figures 7.5 and 7.6 demonstrate the viewing of memories within the database. Figure 7.5 shows how the screen looks when the memory only contains music stimuli. In addition, figure 7.6 highlights the layout when both music and photographs are used.

It was decided to include the image of musical notes within the music only memories, to avoid a blank white screen. In addition, it aimed to intuitively tell the user that the memory was based around music, and therefore, the play button should be pressed (in accordance with guideline 4: provide an interaction which aims to be intuitive). However, initially, this caused confusion and concern with the beta test users, as they were unsure of the the origin of the image.

When there is music associated with a memory, buttons appear to allow the users to directly manipulate the volume of the audio. This aims to simplify the application and eliminate the need for the users to search for the volume buttons on the device (in alignment with guideline 2: encourage interface simplicity and minimise complexity). It will additionally, allow them to customise their interaction with the memories further (guideline 5).

The ability to enlarge a photograph is an important feature. It would allow the users to focus on a specific element of the photograph if required. In addition, it will allow for the image to be made larger to account for any visual impairments which may be encountered by the older people (guideline 3: take into account the possible impairments experienced). The application implements two interaction methods of zooming: buttons, and pinch-zoom. Previous research (Ancient, 2012) found that some older adults can struggle with the dexterity required to operate the pinch-zoom functionality, hence the buttons were included. However, for those adults who regularly utilise touch-screen interaction, pinch-zoom may be an automated response. Therefore, the functionality was added for this group of

users.

In a similar fashion to all other screens within this application, the reminiscence screen has help functionality. This is displayed by default on the first interaction with the application (see figure 7.5). However, this help pane can be closed, to increase the size of the memory viewing area, as can be seen within figure 7.6.

A home button has been included at the top of the screen to return the users back to the main menu. In the prototyping session, the users found it difficult to find the home button to allow them to exit the reminiscence screen. It was suggested that it be coloured bright to make it stand out against the other buttons within the screen.

### 7.3.2.3 Interaction Scenarios

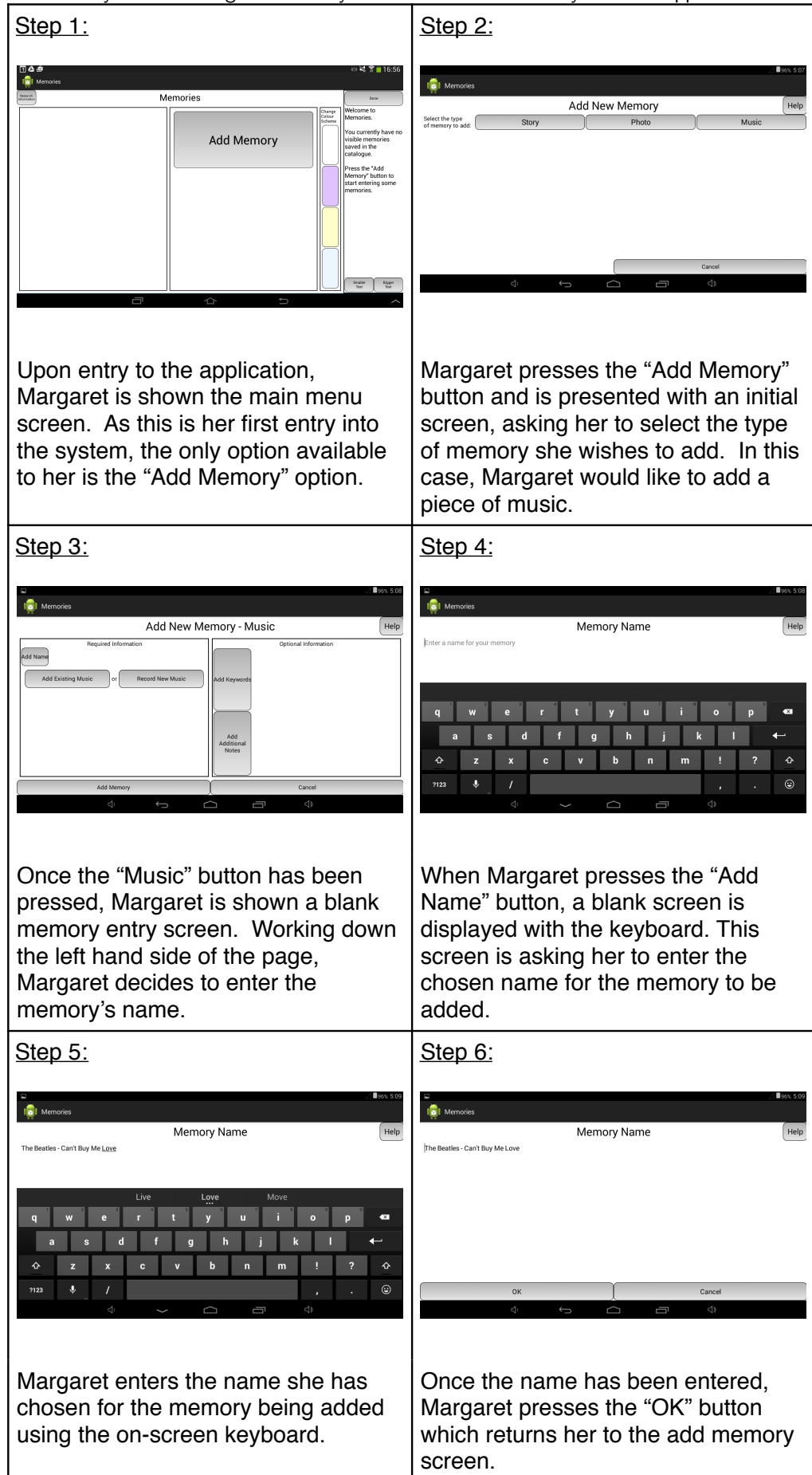
In the following section, two of the main tasks which will be carried out by the users will be modelled through the use storyboarding and personas. Throughout this section, a couple will be modelled, Tom and Margaret. Tom was diagnosed with Alzheimer's type dementia two years ago. He lives at home with his wife, and informal care-giver, Margaret. Both Tom and Margaret represent typical users of the system. They have no previous knowledge of technology, and do not own a computer. On the suggestion of their children, they have decided to purchase a tablet computer to use for reminiscence, and for chatting to their grandchildren using Skype.

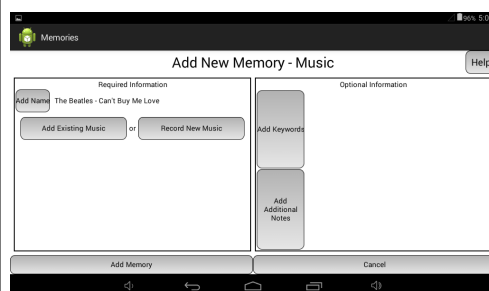
It was initially thought that the entry of memories into the application could be an opportunity for the PwD and their care-giver to engage in reminiscence. Not only would this extend the use of the application, it would also lead to a richer set of entries into the database. However, in practice, the care-givers felt that it was their job to enter the memories, then pass the device to the PwD for them to reminisce on their own. There was some concern from the care-givers that the task of entering the data into the system would be a hard and boring task. In addition, both care-givers felt that they needed to enter all their memories at once before they could use the application (effectively making it a 2-step interaction process), rather than seeing it as a continually evolving database, making the entry of memories into an even more daunting task. It was emphasised to the couples that adding memories could be seen as a reminiscence activity. Despite this encouragement, neither couple did enter their memories together, with the care-giver remaining the sole person who created the memory prompts. To overcome the issue, it could be recommended that the system contains a generic set of memories, which can be edited and added to on a continuous basis. This would overcome the initial barrier to adoption which may exist due to the daunting task of adding all the memories prior to reminiscence.

The two tasks to be carried modelled within this section are: adding a music-based memory, and engaging in reminiscence based on all the memories within the database. Both scenarios are based on how the users actually interacted with the system. Therefore, the care-giver (Margaret) entered the

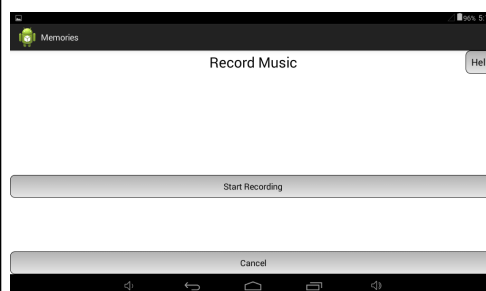
memory into the system (shown in figure 7.7) and the PwD (Tom) viewing the memory (shown in figure 7.8).

Figure 7.7: Storyboard relating to the entry of a music-based memory into the application

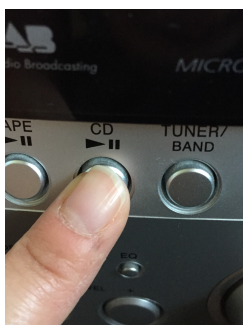


Step 7:

As Margaret doesn't have a computer to transfer music from, she decides to record the music using the on-board microphone. She presses the "Add New Music" button to record her piece of music.

Step 8:

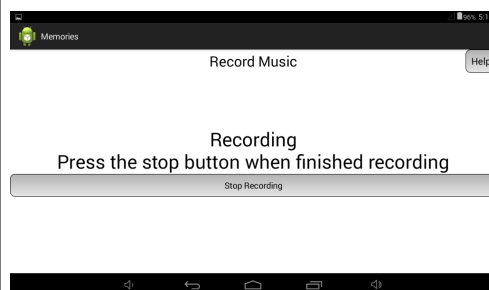
Upon pressing the "Add New Music" button, Margaret is provided with the option to "Start Recording". The application will not start to record the audio immediately, only once Margaret is ready. She presses the button to start the application recording.

Step 9:

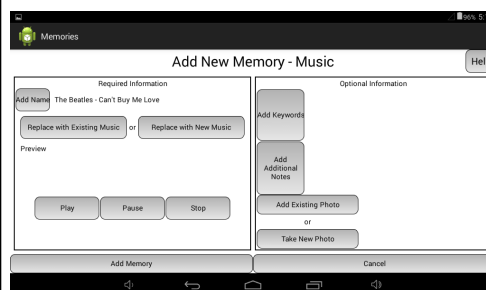
Margaret presses play on her CD player to start the music, and allow the application to record.

Step 10:

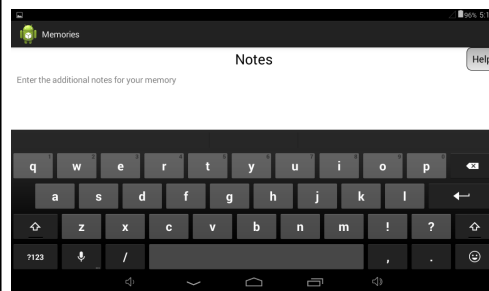
At the end of the piece of music, Margaret presses stop on her CD player.

Step 11:

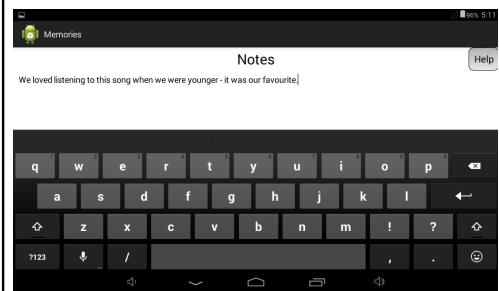
To end the recording, Margaret presses the "Stop Recording" button on the tablet.

Step 12:

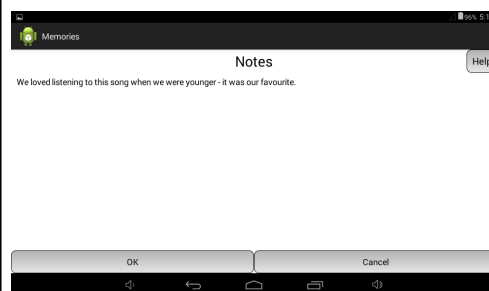
The application returns Margaret to the add memory screen, and the preview buttons are now visible to allow Margaret to listen to the recording, if she wanted to.

**Step 13:**

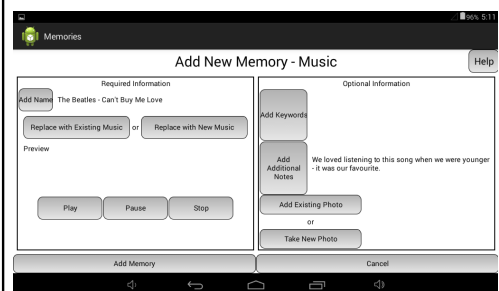
As Margaret wants to add additional notes to the memory she presses the “Add Additional Notes” button. The application displays a similar screen to the “Add Name” option, to allow her to input the additional notes for the memory.

**Step 14:**

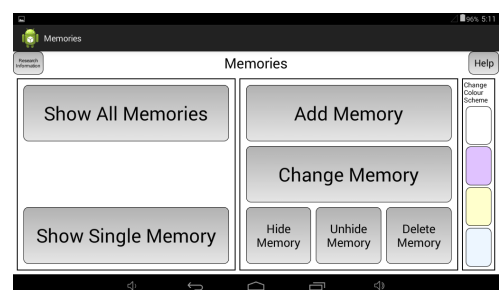
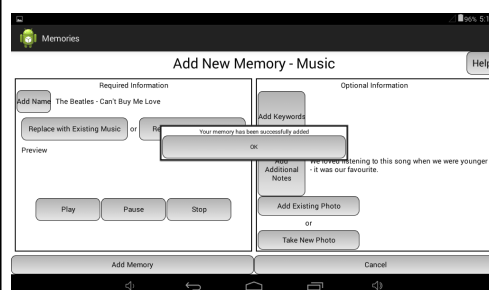
Margaret enters the additional notes for the memory using the on-screen keyboard.

**Step 15:**

Upon completion of typing the additional notes, Margaret presses the “OK” button and is returned to the add memory screen. A preview of the notes entered is displayed next to the “Add Additional Notes” button.

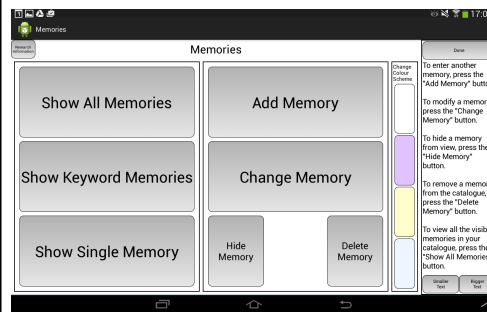
**Step 16:**

Now all the details for the memory have been entered, Margaret presses the “Add Memory” button. A pop-up is shown in the middle of the screen to tell her that the memory has been successfully added.

**Step 17:**

Margaret presses the “OK” button in the pop up and is returned to the main menu screen. As she has now entered at least one memory, more options are now available to Margaret.

Figure 7.8: Storyboard relating to the viewing of all memories within the database

Step 1:

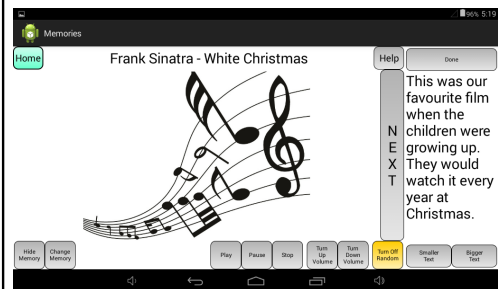
As memories have already been entered into the system, Tom is shown more options than Margaret when he first opens the application.

Step 2:

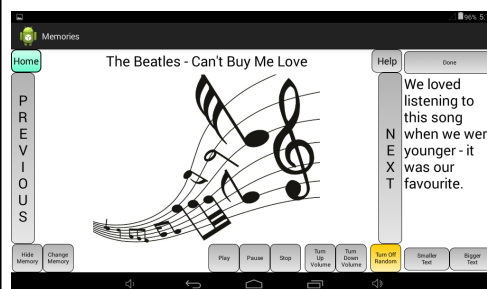
Tom presses the “Show All Memories” button and a memory which has already been input is displayed.

Step 3:

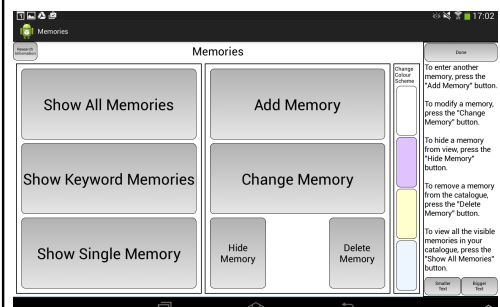
Tom would like to listen to the music linked to the memory, and therefore, presses the play button at the bottom of the screen. The music starts playing.

Step 4:

The font size of the notes is not quite big enough for Tom to read. He presses the “Bigger Text” button until it is big enough.

Step 5:

Once the music has finished playing, Tom presses the “Next” button to view the next memory. *(Note: the font size of the notes has remained at the size that Tom set in the previous memory.)*

Step 6:

When Tom has finished looking at his memories, he presses the “Home” button to return to the main menu.

### 7.3.3 Content Analysis

The following tables display the results from the content analysis conducted on the transcriptions of the focus groups and interviews included within this study.

Table 7.1: Table showing main content analysis codes

Main Code	EFG	PFG	BTFG	PA	PB	Overall
Reminiscence	33.62%	6.80%	15.09%	12.98%	12.26%	14.80%
Technology	27.07%	33.22%	22.22%	17.56%	20.65%	25.46%
Reminiscence Technology	16.38%	57.94%	58.54%	30.92%	48.39%	45.05%
Personal Memories	22.93%	2.04%	4.15%	38.55%	18.71%	14.69%

The main focus of the initial focus group was to validate the findings from the first two studies (detailed in chapters 5 and 6). In accordance with this, the majority of the time was spent discussing reminiscence and technology, as demonstrated in table 7.1 where the percentage of quotes are 33.62% and 27.07% respectively. Whilst there was need to consider the requirements for the application, previous research conducted has found that the carers of PwDs experienced difficulty with imagining a tablet application when it is described as an abstract concept (Ancient, 2012, p. 26). For this reason the majority of the requirements have been gathered based on the literature and previous experiences of technology-supported reminiscence (Ancient, 2012).

After the initial focus group, the topic discussed became more centred around using technology for reminiscence, with a spotlight on the application. Hence, there is a higher proportion of items coded as “reminiscence technology” in these sessions. These sessions all involved the participants interacting with the tablet computers, eliminating the problems associated with their difficulty with applying the abstract concept of using technology for reminiscence with their reduced knowledge of tablet computers.

It quickly became apparent in the first focus group that discussing reminiscence would lead to participants engaging in the activity using their own memories. Whilst this was not the purpose of the focus groups, it was decided not to discourage this, as it would demonstrate how often they reminisce without realising. In addition, the participants seemed to enjoy sharing their stories, giving them an added benefit to taking part and also ensuring they maintained their dignity. As the topic moved away from reminiscence to the application, the frequency of these episodes reduced until the extended test period, when it was discussed again.

The interview with dyad group A included a high proportion of quotes which were personal memories. This can be explained by the fact that the PwD did not remember using the tablet application to reminisce. Therefore, the DSW reminisced with the participants during the interview, leading to a high percentage of quotes relating to the personal memories of the dyad. When these codings are taken



out of the total, the percentages for the reminiscence, technology and reminiscence technologies codes become 21.12%, 28.57% and 50.31% respectively, which is aligned with the results for dyad B.

### 7.3.3.1 Reminiscence

Table 7.2: Table showing content analysis sub codes within items labelled as reminiscence. Percentage based on number of items labelled as reminiscence.

Code	EFG	PFG	BTFG	PA	PB	Overall
Purpose	3.98%	1.47%		3.80%		2.55%
Regularity	1.33%					0.59%
Trigger to Reminisce	13.72%			5.06%	2.38%	7.07%
Reaction	4.42%			16.46%	7.14%	5.11%
Non-Reminiscence	9.29%					4.13%
Memory Prompts	36.28%	86.76%	85.11%	65.82%	90.48%	61.10%
Conversation	3.54%		11.70%	3.80%		4.32%
Management	17.70%	11.76%	3.19%	5.06%		10.81%
Reminiscence Groups	9.73%					4.32%

When investigating the reminiscence activities carried out by the participants, the focus was on the prompts they used to evoke memories. This was consistent across all the sessions carried out, as shown in table 7.2.

The triggers which encourage people to reminisce were discussed during the exploratory focus group and the two participant interviews. It was anticipated that there would be no items coded as “trigger to reminisce” in either the prototyping and beta testing focus groups as the purpose of these were to evaluate the usability and accessibility of the application developed. In addition, the reaction to reminiscence was anticipated to be discussed during the exploratory focus group and participant interviews. During the exploratory phase, the items coded as “reaction” were discussed in order to examine the emotions experienced during and after reminiscence. During the participant interviews after the extended testing period, the items discuss the reaction to reminiscence after using the application.

The items coded as “management” refer to how the participants currently manage their prompts for reminiscence. It was anticipated that these would be discussed during each phase of the studies, as research suggests that older people look at technology in terms of the perceived benefit over and above the method they currently use (Young et al., 2014; Logue & Effken, 2012; Santa-Rosa & Fernandes, 2012).

### 7.3.3.2 Technology

Table 7.3: Table showing content analysis sub codes within items labelled as technology. Percentage based on number of items labelled as technology.

Code	EFG	PFG	BTFG	PA	PB	Overall
Problems with IT	21.60%	22.14%	15.88%	14.60%	5.93%	18.35%
Use	19.75%	13.61%	1.18%		27.41%	12.64%
Disadvantages	5.56%					0.78%
Devices	7.41%	45.74%	13.53%	59.85%	26.67%	35.06%
Non-Use	5.56%	0.54%				1.04%
Learning	15.43%	2.00%	10.00%	1.46%	1.48%	4.94%
Access	1.23%		1.18%		5.19%	0.95%
Introduction	4.94%		0.59%			0.78%
Support	13.58%	14.34%	49.41%	0.73%	2.96%	16.45%
Scams	4.94%					0.69%
Icons			0.59%			0.09%
Advantages		1.45%		5.84%	11.11%	2.68%
Understanding			7.65%	17.52%	19.26%	5.45%
Acceptance		0.18%				0.09%

Table 7.3 demonstrates that during the exploratory and prototype focus groups a large proportion of items were coded as “problems with IT”. This is aligned with research that suggests older people experience problems with technology (van Veldhoven et al., 2008; Gatto & Tak, 2008; Braun, 2013). It also demonstrates the participant’s associate technology with experiencing problems, particularly in the exploratory focus group where the largest proportion of items were coded as problems.

During the prototyping focus group and the participant interviews a high percentage of items were coded as “devices”, which related to discussions about the computers in general and the tablet computer itself. The high percentage in the prototype session can be accounted for as the device was relatively new to the participants, who wanted to understand the device. In addition, the participants who used the application over the extended period experienced problems with the tablet computer, such as poor battery life. In addition, participant B required the computer to be replaced after 4 weeks due to the problems they experienced.

In the focus groups which were geared towards the development of the application, the need for support is regularly discussed. This is particularly apparent in the beta testing group, where 49.41% of the technology codes were related to the support provision. The users were given the application with no onscreen support, with the aim of using the experiences of the using the application to guide the content of the help functionality. It can also be seen that once the help functionality was implemented

the percentage of items which were coded as support reduced. This confirms that the inclusion of a guideline focussing on the need for support to adopt technologies is valid and relevant when considering designing interfaces for older people.

### 7.3.3.3 Reminiscence Technology

Table 7.4: Table showing content analysis sub codes within items labelled as reminiscence technology. Percentage based on number of items labelled as reminiscence technology.

Code	EFG	PFG	BTFG	PA	PB	Overall
App Advantages	4.81%	0.71%		5.50%	9.70%	2.30%
App Use	2.88%	17.70%	12.29%	17.48%	32.12%	17.20%
App Introduction	2.88%	1.96%	2.05%	0.32%	1.82%	1.82%
App Memory Prompts	16.35%	3.91%	6.27%	14.24%	14.55%	7.6%
App Name	13.46%					0.52%
Input	33.65%	4.18%	4.34%	14.24%	4.55%	6.56%
Requirements	25.96%					1.00%
App Problems		15.30%	5.66%	17.15%	3.03%	10.46%
App Features		14.77%	23.61%	10.36%	2.12%	14.87%
Missing Elements		2.94%	16.51%		1.82%	6.53%
App Learning			1.33%		5.45%	1.08%
App Support		8.45%	11.57%	2.91%	6.97%	8.27%
Written Help		1.16%	0.72%	0.97%		0.82%
App Backups			0.60%		1.52%	0.37%
App Understanding		28.56%	0.96%	5.50%	4.24%	13.35%
App Acceptance		0.36%	14.10%	2.91%	3.33%	5.23%
App Reaction				1.29%	7.27%	1.04%
App Trigger				1.62%	1.52%	0.37%
App Non-use				5.50%		0.63%

It was anticipated that the “app use” code would be minimal in the exploratory focus group, as at this stage the application is still in an abstract form, which is not easy for older people to imagine (Ancient et al., 2013). However, from the prototype session onwards the frequency of this code increases as expected because this is the point where the application transitions from abstract to concrete, as shown in table 7.4. It can also be expected that the percentage would increase for the participant interviews after the extended testing period, as these discussions investigated their use of the application during the 8 week period. Whilst the participant B percentage was high at 32.12%, the participant B percentage is not much higher than the prototyping and beta testing groups. However, over the course of the study, “app use” was the code which occurred the most, with 17.20% of the items being coded as such.

The percentage for “app understanding” is much higher in the prototyping focus group than those in other phases of the study. This was due to the carer wanting to have a complete understanding of the purpose and functionality of the application, leading to a significant amount of time being spent explaining the app to him. This allowed the participant to make more informed comments with regards to the features of the application and any usability issues he felt would be encountered.

The “app problems” code allowed issues which were related to the development of the application to be isolated. It could be anticipated that this would be higher in the prototyping and beta testing focus groups, as an element of these groups was to identify problems experienced by the users in order to eliminate them before the extended test period. It would be hoped that the prototyping session would identify the most problems with the application and the beta testers would experience fewer problems, which is in line with the percentages shown in table 7.4. However, whilst it would be difficult to totally eliminate all the bugs in the system, it would not be anticipated for the percentage of items coded with “app problems” to be 17.15% during the extended testing period.

## 7.4 Discussion

The following sections will discuss the qualitative results from the content analysis based on 3 main sections: reminiscence; accessibility and usability; and acceptance. The first two sections aim to discuss the results which link with the first two studies contained within chapters 5 and 6. The final section will aim towards an answer for the research question of this thesis, looking at whether people living with dementia and their care-givers are willing to accept technology as a method for facilitating reminiscence at home.

### 7.4.1 Reminiscence

Earlier research (see chapter 5) suggested that photographs were the most effective memory prompt when reminiscing. In the BTFG, the participants discussed that photographs would probably be the main stimulus which would be entered into the system. This finding was confirmed during the Extended Testing (ET) period, with 85% of the participant's entered memories containing photographs. This could add weight to the finding that visual prompts are more effective at evoking memories than textual memories (Belcher & Kangas, 2013; Cohen-Mansfield, Marx, Thein, & Dakheel-Ali, 2010). However, the participants suggest the reason for addition was not due to their increased effectiveness but because they were “an obvious one to use”. This could imply that the participants were not looking at the most effective types of memory prompt, but the ones which both fitted the system, and were available to them.

The results of the present studies suggest there is a natural focus on positive memories, which aligns with

previous research relating to the positivity effect which occurs as people age (Westerhof et al., 2010, 04; Cappeliez et al., 2008; Dempsey et al., 2014; Westerhof & Bohlmeijer, 2014; Otake, 2015; Uzer & Gulgoz, 2015). One participant in the EFG talks about reminiscing with memories of positive events which have occurred, such as rugby matches which were played with the emphasis on games which were won. This demonstrates the how the positivity effect is interacting with the recalled memories, with the focus on the happier memories of winning games rather than those which were lost.

There is an enjoyment associated with reminiscence, which has been established in the literature (Baillon et al., 2005; J.-J. Wang, 2007; Tolson & Schofield, 2012). This was also found during the EFG, with participants discussing their enjoyment when reminiscing. The participants observed that the emotions of pleasure associated with reminiscence are often experienced in the moment rather than sustained over a longer period of time. One care-giver described feelings experienced as part of another group attended as being forgotten “as soon as he got in the car”. This result has been previously observed by Haight et al. (2003) who found that the positive emotions experienced are only fleeting. Therefore, further research will be required to assess whether these positive emotions can be maintained through regular use of reminiscence.

### 7.4.2 Accessibility and Usability

The application was designed with the guidelines developed in chapter 6 in mind. In addition, an element of the requirements gathering focus group concentrated on the additional needs that older people and those living with dementia have when interacting with technology. Finally, during the prototyping session, any interaction issues were identified and rectified for the final application.

Ancient et al. (2013) previously found that older people struggle to type using an onscreen keyboard. Guideline 9 developed in chapter 6 established that the input modalities must be considered and accounted for during the development of interfaces. The entry of a story would require an extended period of typing using the on-screen keyboard. Therefore, the interface was adapted to apply guideline 9, allowing allow older adults to record themselves telling their story rather than typing it. The functionality to type the story was kept to allow those who do not experience problems with the on-screen keyboard to utilise it. Whilst the participants did struggle at times with the on-screen keyboard, increased practice resulted in the participants increasing the speed with which they could type using the onscreen keyboard. It was commented by one participant that the same effect was found with a standard keyboard, but they did become accustomed to it eventually. This need for regular use has been previously experienced (Patomella et al., 2011; Braun, 2013). Hence, this finding reinforces the need for older people to practice using the system to improve their task performance.

Previous research has found that older people tend to only press the screen lightly, leading to mistakes due to not applying enough pressure (Piper et al., 2010; Hollinworth & Hwang, 2010). Whilst this

the participants did experience challenges applying the correct amount of pressure, it was related to pressing too hard and too long on the screen. However, one care-giver found that they needed to tap the screen rather than pushing it, something which the PwD found challenging to remember. During the discussion, it was reasoned that this effect could be due to originally learning to type on a typewriter, where a large amount of pressure was required to press a button. In contrast, a touchscreen keyboard had a higher sensitivity making it difficult to apply the right amount of pressure something which would have not been experienced with the physical keyboards associated with modern computers.

it has been suggested that touchscreen devices are inappropriately calibrated for the characteristics of older people's fingers (Barnard et al., 2013). This study indicated that typewriters were more appropriately designed for their "fat" fingers with larger keys and bigger gaps between them. This correlates with previous research findings that buttons should be larger in size (D. Williams et al., 2013; Or & Tao, 2012; Dickinson et al., 2011; Mertens et al., 2012) and have an increased gap between them (Ali et al., 2012; K. Chen et al., 2013). Not only will this take into account the different size of fingers that older people may have, but also support their reducing dexterity (Biswas et al., 2011; Charness & Boot, 2009; Renaud & van Biljon, 2008), counteract visual impairments (Fromme et al., 2011; Hough & Kobylanski, 2009; Ali et al., 2013; Y.-C. Hwang, 2011; Santa-Rosa & Fernandes, 2012), and overcome challenges experienced due to inappropriate button design (D. Williams et al., 2013; Ali et al., 2012; Dickinson et al., 2011).

### 7.4.3 Acceptance

The following section will discuss the acceptance of the theory-based reminiscence application by the participants. The following factors which have been previously discussed in chapter 6 will be included: introduction to technology, the TAM, and support provision.

#### 7.4.3.1 Introduction to Technology

The lack of familiarity with tablet computers is a potential barrier to adoption of this method of facilitating reminiscence (Boontarig et al., 2012; Ji et al., 2010; Logue & Effken, 2012; Taylor et al., 2014). This was something which was mentioned during the final interview with dyad B, when they stated that the preference would be to use the computer, but only because it was familiar to them. The participants did believe that once they had used the tablet computer more and got used to its operation they would find it easier to use when compared to the computer. This is in line with existing research that suggests familiarity with a device is vital to improving acceptance and rates of adoption in older generation (Patomella et al., 2011; Braun, 2013). The slightly increased familiarity with the technology experienced during the extended testing period allowed one participant to become quicker when interacting with the device.

The participants regularly expressed their concern that their actions would “break” the tablet, despite being assured that anything they did could be undone if necessary. This is regularly experienced by older adults who are in the early stages of adopting a new device (Barnard et al., 2013; Nasmith & Parkinson, 2008; Nijhof et al., 2013; Ji et al., 2010; Greengard, 2009), which is in stark contrast to younger generations who regularly engage in trial and error learning and appear to have no fear. However, one participant did acknowledge that after using the device for a while he had learnt to trust that it cannot be broken, and therefore, now finds it easier to engage in a trial and error learning method. This demonstrates that regular use of a system has the potential to increase a person’s confidence in themselves and the device (Wild et al., 2012).

A concern which is often cited in the literature is the potential for technology to lead to anti-social behaviours (Hakkarainen, 2012; Barnard et al., 2013; K. Chen & Chan, 2013; Michaud et al., 2010). This was also expressed by the participants of this study who were concerned that using the tablet computer would lead to spending too long using the device in a similar manner to their grandchildren, who use their phones for a large amount of time. The participants felt that this behaviour was irritating. However, it could be argued that this will not be a problem, as the application is designed as a conversation aid rather than a replacement of social interaction. Additionally, the application has not been developed as something for the person living with dementia to do on their own.

#### **7.4.3.2 The Technology Acceptance Model**

Despite the input of memories into the catalogue being described as easy to use, it was a time consuming process with one participant commenting that “it certainly needs some commitment from the person who is going to be doing the inputting”. This was discussed during both the development process and the extended testing period. This time consuming nature of the input was often cited as a reason for not using the system more. A possible solution in order to get over this issue is to provide a set of generic memories with the application that the users are able to edit and also add their own memories. This generic set of memories would have the same capabilities as the personalised system in that users should be able to edit and delete memories to suit them. Therefore, participants will still be able to benefit from the increased positive emotions which are elicited as a result of personalised memories (Cohen-Mansfield, Thein, et al., 2010), which has been previously established within this research project. In addition, this would align with guideline 10 (developed in chapter 6) as it will support the users in their initial adoption, ensuring the system is appropriate for them before they invest the time required to enter their personal memories. If implemented, the generic memory bank should be developed in conjunction with people living with dementia and their care-givers to ensure the memories are relevant and effective. This would give the users a baseline of memories, giving them the opportunity to gradually add memories to the system, rather than being expected to add them all in one go, leading to an improved experience of inputting memories into the catalogue, whilst maintaining

benefits associated with personalised memories.

Ensuring there is a perception of usefulness is important to increase adoption of new technologies (Hart et al., 2008; Hanson, 2010; Chaiwoo et al., 2011), which was highlighted in chapter 6 as an important consideration when designing interfaces for older adults (guideline 8: demonstrate usefulness and benefit to the users). Throughout the design, development and testing process the participants described the application as a good idea which would potentially be useful for them. This was particularly apparent during the final interview of participant B, who was disappointed that the tablet was being taken away, despite knowledge that the testing period was finite. Both dyads who participated in the extended testing period expressed an interest in purchasing a tablet for themselves in order to be able to continue using the application, with one care-giver commenting that she thought they would “take that big step”. This finding could also add further justification to previous research which has shown that physical contact with technology can improve the acceptance of new technologies (Hough & Kobylanski, 2009; Peeters et al., 2012; Barnard et al., 2013; Wilkowska & Ziefle, 2009; Nasir et al., 2008; Braun, 2013; Ryu et al., 2009). Before taking the tablets home for an extended period of time, both dyads were sceptical about the potential benefits of using technology to facilitate reminiscence, however, after 8 weeks with the tablets, both couples were keen to purchase their own device to continue using the technology. This acceptance of the device was further enhanced when the participants realised that the tablet could be used for other purposes, not just as a device for reminiscence. This added value is something which was also discussed during the prototype session, with the care-giver commenting that they would be happy to the tablet device on the condition that the device was multi-purpose (such as including a diary) to avoid carrying around too many items. In addition, this finding also validates research which has found that added incentives to use a technology can improve the adoption of technologies (Vastenburg et al., 2008; J. Zhou et al., 2012).

Ryu et al. (2009) and Braun (2013) both recommend that new devices are demonstrated to older people in terms of how they produce an added benefit over existing solutions. This is also a consideration in the guidelines produced in chapter 6, with number 8 requiring the benefit to be demonstrated to potential users. The participants in this research project often actively considered the application in terms of advantages over their more traditional methods of managing reminiscence activities, especially with respect to photo albums. In particular, the addition of the music element and the ability to add captions to the images. Whilst one dyad felt that they did not particularly need the captions as they “just need to look at the picture and it just comes back to us”, they did agree that the captions would allow someone else the opportunity to pick the device up and reminisce with the person living with dementia with minimal effort. This suggests that proving the new technologies will be of benefit to older people and are worth the time it would take to learn how to use them.

Portability of the device was often cited as an advantage to adopting a reminiscence program which is implemented using technology. This would allow the users to engage in reminiscence activities wherever



they wanted, without needing to transport large photo albums. There is talk of using the device as a way of passing the time or avoiding the person living with dementia becoming bored. However, care needs to be taken when using the application to pass the time, as this may become boredom reduction, which can be associated with the negative functions of reminiscence (P. T. Wong & Watt, 1991). In addition, the portability will allow the care-giver to continue using the materials should the person living with dementia move into care, helping them to maintain their relationship.

#### 7.4.3.3 Support

The provision of support is an important point which was discussed in all the focus groups and both interviews, confirming the importance of it's inclusion as a guideline for developing interfaces identified in chapter 6. This also aligns with research which suggests that older people require a strong support network when beginning to use new technology (Barnard et al., 2013; L. Wang et al., 2011; Faucounau, Wu, Boulay, Rotrou, & Rigaud, 2010). However, one care-giver provided contradictory information, stating that support was important, but not using the onscreen help. This lack of use is due to previous encounters with help functionality proving to be unhelpful. Poor previous experiences influencing current adoption habits is not a new concept, and has been regularly cited in the literature (Higgins & Glasgow, 2012; Wandke et al., 2012; Barnard et al., 2013). However, whilst this problem has been recognised, there are currently no solutions as to how to reverse this effect and encourage older adults to utilise new technologies despite the negative previous experiences.

Providing an appropriate level of support is important when introducing older adults to new technologies (Barnard et al., 2013). Therefore, in line with the suggestion by Taylor et al. (2014) that older adults should inform the development of help functionality, it was decided that the participants of the beta test group should help to inform the on-screen support provided. By not providing minimal onscreen support, it was hoped that they would be able to find the areas in which they struggled, which could in turn guide the help functionality. Participants were provided with a sheet to add any points that they believed should be included within the help functionality. By managing the implementation of the help functionality this way, it could be ensured that the support provided was presented at an appropriate level for the users, giving them the necessary interaction scaffolding without patronising them (J. Zhou et al., 2012). However, the participants in the beta test group stated that they needed a "for dummies" version of the support. This would allow them to be fully supported through their interaction with the system.

In an attempt to satisfy requirements for support at the point of need (J. Zhou et al., 2012), throughout the beta and extended testing phases participants were provided with direct access to the principal researcher in order to obtain technical support. This was only utilised by one participant, who seemed to experience high levels of technology anxiety. When asked about this support network, they found it

useful to have the “facility” but were reluctant to cause any disturbance. In addition, the participant commented that they wanted to persevere with attempting to solve the problem before calling “the cavalry”. The participant believed this need to solve the problem by themselves was a generational difference commenting “I suppose that is what a younger person would do, immediately go for some help, whereas I guess we have been used to sorting it out”.

Participants in this study demonstrated a preference for printed instructions to support their interactions. This presents an interesting problem for future adoption. With the current trend towards electronic manuals, older adults may not receive a hard-copy manual with their purchase. Therefore, they would need to download and print the instructions. This makes the assumption that older adults have the equipment required to download and print the manual, which cannot be assumed. Additionally, research conducted by Taylor et al. (2014) found that older adults are reluctant to download files from the internet, due to fears associated with malware. This concern was also expressed by a participant during the EFG, suggesting the findings of Taylor et al. (2014) may be valid. This is a problem which will persist, not only for this research project, but for acceptance in general. In the cases where older adults are supported to adopt technology (as suggested in guideline 10, see chapter 6), this may not be a problem as the person aiding the adoption process will be able to ensure that a paper copy of the instruction manual is made available. However, in the situation where the older person is self-adopting, this may not be possible.

## 7.5 Conclusion

This chapter has presented the findings of the final two studies conducted as part of this research to develop a theory-based reminiscence program which can be facilitated on a tablet computer. It has been found that there is the potential for older adults, including those living with dementia, to accept the developed program. This chapter has built on previous research within this thesis (discussed in chapters 5 and 6). It has incorporated the finding that personalised memories based on stimuli which use photographs, stories, and music seem to be more likely to evoke positive emotions.

This study is limited in that it does not incorporate any quantitative analysis. Therefore, all the findings are subjective, and as such, non-replicable. Despite this, it does point to the fact that older people may be willing to accept new technologies, in this case, a theory-based reminiscence program which has been implemented on a tablet computer. Future research should investigate whether the long-term acceptance of the developed program can be quantified and, as such, measured.

The following chapter will conclude the thesis, with a discussion of the results of the research project undertaken.

## CHAPTER

# 8

## CONCLUSION

Dementia is worldwide problem, which as the population “greys” becomes increasingly important to manage. With two-thirds of the PwDs in the UK living within the community (Alzheimer’s Society, 2013), it is vital to produce interventions which can be carried out at home with ease to mitigate the behavioural challenges associated with the condition. Reminiscence therapy is described as an enjoyable, easy-to-administer, and beneficial intervention, which is often used with PwDs. The aim of this research was to develop a theory-based reminiscence program which could be implemented on a tablet computer and assess it’s acceptance. This research has demonstrated that there is the potential for older adults, and those living with dementia, to accept a program which has been developed based on theory and implemented on a tablet computer. Theory was used and developed to ensure that the memories incorporated within the reminiscence program successfully evokes memories which lead to positive emotions in the reminiscer. Additionally, guidelines for designing interaction principles for PwDs were developed to ensure that the implementation of the theory-based reminiscence program was appropriate for the target users.

In order to achieve the aims of this research and answer the research question, a number of objectives were achieved.

*Objective 1: To investigate the types of stimuli which are most effective at evoking memories*

*Objective 2: To investigate the types of memory which are most effective at evoking positive emotions*

The first study conducted (discussed within chapter 5) aimed to achieve both the first and second objectives. A quantitative study involving a specifically developed questionnaire was utilised and hypothesis testing conducted to establish the optimal stimuli and types of memory to evoke positive emotions from recollections. The research suggested that the optimal types of stimulus which should be included within the developed application are photographs, stories, and music. In addition, it was found that personalised memories should be utilised rather than generic ones, in order to promote positive emotions.

*Objective 3: To develop guidelines to inform development of interfaces which are appropriate for PwDs*

Chapter 6 aimed to achieve the third objective. Using secondary research, involving a systematic literature search and synthesis, ten guidelines were established in order to develop interfaces which are designed to be inclusive for older adults, especially those living with dementia. The guidelines are:

1. Provide a system which is user-paced
2. Encourage interface simplicity and minimise complexity
3. Develop an easy-to-use system, which takes into account the possible impairments experienced
4. Provide an interaction which aims to be intuitive, but with provision for training and post-adoption support
5. Provide options for interface customisation
6. Where possible, avoid the use of hierarchical navigation structures
7. Enhance available resources, whilst supporting those which have declined
8. Demonstrate usefulness and benefit to the users
9. Choose input and output modalities appropriate to the users and the tasks to be performed
10. Provide support to adopt new technologies

Table 6.2 in chapter 6 demonstrates how the challenges identified can be mapped to the guidelines. The developed guidelines were used to inform the design of the interface for the developed reminiscence program.

*Objective 4: To investigate the acceptance of the developed reminiscence program*

Objective four was achieved whilst completing the final two studies, which are detailed in chapter 7. Participatory design techniques were utilised in order to design and build an implementation of the theory-based reminiscence program which was developed earlier in this research project. Additionally, potential users were invited to use the developed program within the home environment in order to

assess whether they would be willing to adopt the implementation. The results of the study do suggest that PwDs and their care-givers are potentially willing to accept a reminiscence program which has been implemented on a tablet computer.

## 8.1 Contribution to Knowledge

This research makes three contributions to knowledge: insight into the optimal stimuli to evoke positive emotions, guidelines to inform development of interfaces for use by older people and those living with dementia, and the potential acceptance of a reminiscence program which is implemented on a tablet computer.

Firstly, this research investigated the optimal memory type and stimuli to evoke positive memories. It suggests that the optimal types of memory are photographs, stories, and music, with newspapers and videos being less effective at evoking memories. Additionally, it was found that personalised memories may induce greater positive emotions than generic memories which occur on a national or international stage. As a direct result of this contribution, the developed program only supported personal memories which use photographs, stories, and music.

Secondly, guidelines were developed which can inform the design of future applications to ensure that they are accessible to PwDs. These guidelines informed the development of the application used to test the reminiscence program. However, these guidelines can be applied to any applications developed with PwDs in mind.

Finally, it has been demonstrated that the potential for older adults to accept using a reminiscence program which has been implemented using tablet computers within the home environment. This research has only acted as a proof of concept in which to demonstrate that there is the potential for PwDs and their care-givers to accept an implementation of reminiscence on tablet computers.

## 8.2 Anticipated Impact

Overall, this research has the potential to support PwDs and their care-givers when trying to engage in reminiscence activities within the home environment. Reminiscence provides PwDs with the opportunity to participate in an activity which can empower them, allowing them to fully contribute to the conversation. Reminiscence can support PwDs through their interaction with other people, potentially fostering and renewing bonds. Facilitating reminiscence through the use of tablet technology could make the conversation aid both accessible and portable, increasing the potential for more flexible use. Existing implementations of reminiscence are often generic in nature, restrictive, and inaccessible to PwDs. Through developing a reminiscence program which has been tailored to their needs in respect

to evoking memories for positive emotions then implemented on a tablet computer, reminiscence can become more effective and accessible.

In chapter 5 the optimal type of, and prompt for, memories was investigated. The results suggest that personalised memories which are evoked using photographs, stories, and music are most likely to successfully evoke memories of a positive nature. This has the potential to support traditional reminiscence sessions. If the facilitator has a knowledge of the most effective memory types and stimuli for their attendees they can tailor their session to their needs, potentially increasing the effect of the session..

The guidelines developed in within the second study (detailed in chapter 6), have the potential to be used by interface designers when they are producing computerised systems for use by PwDs. In addition to the symptoms associated with the condition PwDs will experience the effects of the natural ageing process. Therefore, the guidelines developed should also support the needs of older adults who are not living with the condition. Furthermore, the findings of this study adds to the existing guidelines which have been published by the W3C Commission, particularly in the area of cognitive impairment. The existing guidelines relating to cognitive needs are limited. Through the addition of the guidelines developed within this research project interfaces which need to be utilised by older people who are experiencing challenges associated with cognitive decline can become more accessible.

Outside the dementia domain, research suggests that reminiscence can have a positive effect on people who are living with other mental health conditions (Westerhof et al., 2010, 04). Therefore, there is the potential that this application can be adapted and extended to support other people to reminisce at home.

## 8.3 Research Limitations

This research has a number of limitations: a small sample size, limited testing of interface guidelines, no validation of data coding, only one prototyping session was conducted, and acceptance was measured using qualitative data. These limitations will be considered further in the following section.

Firstly, the number of participants including in all stages of the research project was small. This was in part due to the small pool from which participants could be drawn. In the first study, which evaluated the perception of memories, significant results were still established despite this lack of respondents. Due to this small sample size, the results obtained cannot be claimed to be conclusive, however, they do point towards a possible trend. Future research should aim to overcome this issue.

Secondly, this research did not exclusively test the guidelines which have been developed using secondary research. Whilst the final evaluation study did briefly consider the ease of use of the system, the results are subjective to the participants included within the study. Therefore, there is the potential

that the developed guidelines may not be adequate for the target users. In order to overcome this limitation, future research should aim to evaluate the guidelines developed using known usability evaluation techniques.

Thirdly, the content analysis coding was not subjected to validation. Due to only one researcher coding the quotes used within the content analysis, the results are subject to bias. Future research should aim to remove this limitation, through the use of at least another researcher coding the quotes. Therefore, the biases of the single research can be minimised and the codes developed through the grounded analysis could be improved.

Fourth, during the development phase, only one prototype session was conducted. Ideally, multiple prototyping sessions should be carried out in order to evolve the system. This study utilised the guidelines developed in the second study. However, it could be argued that just one prototyping session, with a low number of users, is not sufficient to ensure that all interaction issues are accounted for.

Finally, in order to assess the acceptance of the device, qualitative research was conducted. Therefore, it will be difficult to conclusively determine that the application would be accepted by the participants, as subjective opinions were provided. Future research should aim to quantitatively evaluate the acceptance of the device with a larger cross-section of users.

## 8.4 Future Research Directions

There are many directions this research can be extended into. The following section will discuss potential avenues in which the findings of this project can be evolved.

Firstly, the evaluation of memory types to include within the reminiscence program involved a small sample size. Therefore, future research could aim to achieve a higher number of respondents, which could lead to the use of more rigorous parametric testing. In addition, this larger sample size should include a greater number of PwDs. This would allow for a comparison between the results of people who are living with the condition and those who are not. Additionally, further analysis could be conducted to assess whether there are any significant differences in the findings for younger and older people. Research suggests that reminiscence occurs throughout the life span (Westerhof et al., 2010, 04) and that the process of recalling positive memories may have a positive impact on younger adults too. It would be interesting to evaluate whether there are any differences in the stimuli used to evoke memories and the types of recollection which instigate positive emotions for younger adults when compared to the elderly.

Secondly, due to the large amount of research which has been conducted relating to the interaction needs of older adults, the articles gathered within the second study were quite restrictive. Through

broadening the scope of the inclusion criteria to include articles which discuss other topics (and include interface design on the periphery) and older articles a larger wealth of information would be gathered. In addition, the study carried out did not include snowballing of articles. Future research should resolve this missing element.

Thirdly, the guidelines produced were not tested in a formal manner. Therefore, future research should aim to test the effectiveness of the developed guidelines with the target user group. This testing may bring to light challenges which were not highlighted within the literature, resulting in further evolution of the developed guidelines. In addition, the guidelines are should be benchmarked against existing guidelines for older people, and usability heuristics, such as those produced by Sneidermann and Nielsen.

Fourth, the design phase of the application only included one iteration of the prototyping stages of the framework demonstrated in figure 2.1. However, more iterations would have evolved the application further to include features and interaction issues which may have been missed. In addition, the participants included within the prototyping session had previously used a tablet computer and as such, may not have experienced all the interaction challenges that a novice user may have encountered. Therefore, future research should include a broader cross section of potential users.

Fifth, future research should investigate adoption and continued use over a period which is longer than eight weeks. This research has suggested that a reminiscence program based on positive emotions has the potential to be accepted by older adults. However, more investigation is required to assess whether this would remain the case over a longer period of time or whether the novelty will diminish.

Finally, an evaluation of whether the developed reminiscence program has a tangible effect on the well-being of PwDs and their care-givers should be carried out. This research should be carried out in comparison to existing implementations of reminiscence therapy, and with participants who are acting as a control group. Additional metrics, such as care-giver burden and behavioural challenges, should be utilised to consider the QoL of the PwDs and their care-giver from a holistic perspective in relation to the developed reminiscence program. It has been found that 85% of applications within the NHS-accredited mental health apps were undefined in relation to their clinical benefit (Leigh & Flatt, 2015). Therefore, there is vital need for applications to be evaluated and assessed against known clinical measures is required, not just for this theory-based reminiscence app, but also other products which are endorsed and accredited by the NHS.

## 8.5 Learning Reflection

The following section will outline the learning which has occurred throughout the process of completing this research project. Nothing runs smoothly, and this project was no different. A number of lessons have



been learnt. These broadly cover: ethical review, conducting research in coordination with charities, and participatory design involving PwDs.

Firstly, the ethical review process will be considered. Initially, it was considered that due to the involvement of PwDs a review under the MCA was required. However, as the participants were required to have capacity, otherwise they would not be able to actively engage in the process. Therefore, review conducted by the university ethics board would be sufficient. Prior to submission of ethical paperwork, a thorough consideration of the potential participants must be conducted to assess whether an ethical review under MCA is required. In addition, where possible, it would be advisable to consult members of a NHS REC prior to submission to gain an opinion on whether the research does require a review under the MCA.

Secondly, the number of participants, which was initially small, was reduced further due to an unexpected delay in obtaining permission from the Alzheimers Society. The support manager for the relevant area was consulted prior to approaching potential participants, and approval was gained. However, after recruitment, it was found that a particular process should have been followed to obtain official permission to approach clients of the Alzheimers Society. This led to a delay in obtaining the final permission. In an attempt to avoid this problem in future research, it is recommended that the chief researcher approaches the central team at the relevant charity. This would ensure that the correct people are spoken to, and the relevant procedures followed. In addition, discussing the research and obtaining permission from a centralised part of the charity may lead to a greater area in which to recruit potential participants from. This could also result in an increased sample size.

Finally, conducting participatory design techniques with older people was a challenging prospect. This particular demographic tend to have less experience with technology (M.-Y. Hwang et al., 2009, 2011; Taveira & Choi, 2009; Ji et al., 2010; Schneider et al., 2008). In addition, previous research conducted found that participants found it challenging to image a tablet application when presented in an abstract format. It is, therefore, recommended that techniques which are used to elicit the views of potential users are flexible to take into account the varying needs and abilities of the target audience.

## 8.6 Conclusion

In summary, this research has developed a theory-based reminiscence program which has been implemented on a tablet based application. The potential acceptance of the developed program and its implementation was assessed. This thesis has discussed the evaluation of memory types and recollection stimuli with the aim of evaluating the most effective type to ensure that positive emotions are evoked. This has shown that personalised memories which are evoked using photographs, stories and music are the optimal type for people over the age of 50. Additionally, this research developed a set of guidelines

which can inform the development of interfaces for PwDs and older adults. The findings of these two elements were incorporated into a theory-based reminiscence program which was implemented using a tablet computer. A qualitative analysis using interviews and focus groups found that older people and those living with dementia were potentially willing to accept the developed theory-based program. However, due to the small sample size involved, further research is required to conclusively prove that the intervention will be accepted within the general population.

# BIBLIOGRAPHY

- 6, P. & Bellamy, C. (2011). *Principles of methodology: research design in social science*. Sage.
- Abdullah, M. Y., Salman, A., Razak, N. A., Noor, N. F. M., & Malek, J. A. (2011). Issues affecting the use of information and communication technology among the elderly: a case study on jenii. In *2011 ieee 10th malaysia international conference on communications (micc)* (pp. 29–32). 2nd - 5th October 2011.
- Ali, N. M., Norizan, A. R., & Shahar, S. (2013). Enhancing user interaction in a nutritional educational package for the elderly using 3d animation. *Journal of Theoretical & Applied Information Technology*, 47(3), 1323–1330. 86703960 Journal of Theoretical & Applied Information Technology 19928645. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=edo&AN=86703960&site=eds-live>
- Ali, N. M., Shahar, S., Kee, Y. L., Norizan, A. R., & Noah, S. A. M. (2012). Design of an interactive digital nutritional education package for elderly people. *Informatics for Health and Social Care*, 37(4), 217–229. doi: 10.3109/17538157.2012.654843 1753-8157. Retrieved from <http://dx.doi.org/10.3109/17538157.2012.654843>
- Allen, R. J., Schaefer, A., & Falcon, T. (2014). Recollecting positive and negative autobiographical memories disrupts working memory. *Acta Psychologica*, 151, 237–243. doi:<http://dx.doi.org/10.1016/j.actpsy.2014.07.003>
- Alm, N., Astell, A., Ellis, M., Dye, R., Gowans, G., & Campbell, J. (2004). A cognitive prosthesis and communication support for people with dementia. *Neuropsychological Rehabilitation*, 14(1/2), 117–134. dc.publisher: Taylor and Francis. doi:10.1080/09602010343000147

- Alm, N., Dye, R., Gowans, G., Campbell, J., Astell, A., & Ellis, M. (2007). A communication support system for older people with dementia. *Computer*, 40(5), 35–41. doi:<http://doi.ieeecomputersociety.org/10.1109/MC.2007.153>
- Alzheimer's Society. (2012). What is dementia? Retrieved from [http://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=106](http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=106)
- Alzheimer's Society. (2013). Dementia 2013: the hidden voice of loneliness. Retrieved from [https://www.alzheimers.org.uk/site/scripts/download\\_info.php?downloadID=1056](https://www.alzheimers.org.uk/site/scripts/download_info.php?downloadID=1056)
- Ancient, C. (2012). *I remember when...: a mobile application to aid reminiscence with dementia patients* (Master's thesis, University of Portsmouth, Portsmouth).
- Ancient, C. & Good, A. (2013). Issues with designing dementia-friendly interfaces. In C. Stephanidis (Ed.), *Hci international 2013 - posters' extended abstracts* (Vol. 373, pp. 192–196). Communications in Computer and Information Science. 978-3-642-39472-0. Berlin: Springer Berlin Heidelberg. Retrieved from [http://dx.doi.org/10.1007/978-3-642-39473-7\\_39](http://dx.doi.org/10.1007/978-3-642-39473-7_39)
- Ancient, C., Good, A., Wilson, C., & Fitch, T. (2013). Can ubiquitous devices utilising reminiscence therapy be used to promote well-being in dementia patients? an exploratory study. In C. Stephanidis & M. Antona (Eds.), *Universal access in human-computer interaction. applications and services for quality of life* (Vol. 8011, pp. 426–435). Lecture Notes in Computer Science. Springer Berlin Heidelberg. doi:10.1007/978-3-642-39194-1\_50
- Arning, K. & Ziefle, M. (2009). Effects of age, cognitive, and personal factors on pda menu navigation performance. *Behaviour & Information Technology*, 28(3), 251–268. doi: 10.1080/014492907016793950144-929X. Retrieved from <http://dx.doi.org/10.1080/01449290701679395>
- Ashida, S. (2000). The effect of reminiscence music therapy sessions on changes in depressive symptoms in elderly persons with dementia. *Journal of Music Therapy*, 37(3), 170–182. doi:10.1093/jmt/37.3.170. eprint: <http://jmt.oxfordjournals.org/content/37/3/170.full.pdf+html>
- Astell, A. J., Ellis, M. P., Bernardi, L., Alm, N., Dye, R., Gowans, G., & Campbell, J. (2010). Using a touch screen computer to support relationships between people with dementia and caregivers. *Interacting with Computers*, 22(4), 267–275. doi:10.1016/j.intcom.2010.03.003. eprint: <http://iwc.oxfordjournals.org/content/22/4/267.full.pdf+html>
- Astell, A., Alm, N., Gowans, G., Ellis, M., Dye, R., & Vaughan, P. (2008). Involving older people with dementia and their carers in designing computer based support systems: some methodological considerations. *Universal Access in the Information Society*, 8(1), 49–58. doi:10.1007/s10209-008-0129-9
- Azcurra, D. J. L. S. (2012). A reminiscence program intervention to improve the quality of life of long-term care residents with alzheimer's disease. a randomized controlled trial. *Revista Brasileira de Psiquiatria*, 34(4), 422–433. doi:<http://dx.doi.org/10.1016/j.rbp.2012.05.008>

- Baillon, S., Van Diepen, E., Prettyman, R., Redman, J., Rooke, N., & Campbell, R. (2004). A comparison of the effects of snoezelen and reminiscence therapy on the agitated behaviour of patients with dementia. *International Journal of Geriatric Psychiatry*, 19(11), 1047–1052. doi:10.1002/gps.1208
- Baillon, S., van Diepen, E., Prettyman, R., Rooke, N., Redman, J., & Campbell, R. (2005). Variability in response of older people with dementia to both snoezelen and reminiscence. *The British Journal of Occupational Therapy*, 68(8), 367–374. doi:10.1177/030802260506800805. eprint: <http://bjo.sagepub.com/content/68/8/367.full.pdf+html>
- Barnard, Y., Bradley, M. D., Hodgson, F., & Lloyd, A. D. (2013). Learning to use new technologies by older adults: perceived difficulties, experimentation behaviour and usability. *Computers in Human Behavior*, 29(4), 1715–1724. 0747-5632. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0747563213000721>
- Beauchamp, T. L. & Childress, J. F. (1989). *Principles of biomedical ethics*. New York ; Oxford : Oxford University Press.
- Belcher, J. & Kangas, M. (2013). Autobiographical memory specificity in response to emotion pictorial cues among non-clinical participants. *Australian Journal of Psychology*, 65(4), 250–257. doi:10.1111/ajpy.12027
- Berntsen, D. (1996). Involuntary autobiographical memories. *Applied Cognitive Psychology*, 10(5), 435–454. doi:10.1002/(SICI)1099-0720(199610)10:5<435::AID-ACP408>3.0.CO;2-L
- Biswas, P., Robinson, P., & Langdon, P. (2011). Designing inclusive interfaces through user modeling and simulation. *International Journal of Human-Computer Interaction*, 28(1), 1–33. doi:10.1080/10447318.2011.565718 1044-7318. Retrieved from <http://dx.doi.org/10.1080/10447318.2011.565718>
- Bluck, S. & Levine, L. J. (1998, March). Reminiscence as autobiographical memory: a catalyst for reminiscence theory development. *Ageing and Society*, 18(02), 185–208. Retrieved from [http://journals.cambridge.org/article\\_S0144686X98006862](http://journals.cambridge.org/article_S0144686X98006862)
- Bohlmeijer, E., Valenkamp, M., Westerhof, G., Smit, F., & Cuijpers, P. (2005). Creative reminiscence as an early intervention for depression: results of a pilot project. *Aging & Mental Health*, 9(4), 302–304. PMID: 16019285. doi:10.1080/13607860500089567. eprint: <http://dx.doi.org/10.1080/13607860500089567>
- Bohlmeijer, E., Westerhof, G., & Jong, M. E.-d. (2008). The effects of integrative reminiscence on meaning in life: results of a quasi- experimental study. *Aging & Mental Health*, 12(5), 639–646. PMID: 18855180. doi:10.1080/13607860802343209. eprint: <http://dx.doi.org/10.1080/13607860802343209>
- Bond, J. & Corner, L. (2001). Researching dementia: are there unique methodological challenges for health services research? *Ageing and Society*, 21(1), 95–116. doi:10.1017/S0144686X01008091

- Boontarig, W., Chutimaskul, W., Chongsuphajaisiddhi, V., & Papasratorn, B. (2012). Factors influencing the thai elderly intention to use smartphone for e-health services. In *2012 ieee symposium on humanities, science and engineering research (shuser)* (pp. 479–483). 24th - 27th June 2012.
- Braak, H. & Braak, E. (1991). Neuropathological staging of alzheimer-related changes. *Acta Neuropathologica*, 82(4), 239–259. doi:10.1007/BF00308809
- Brandt, A. M. (1978). Racism and research: the case of the tuskegee syphilis study. *The Hastings Center Report*, 8(6), 21–29. Retrieved from <http://www.jstor.org/stable/3561468>
- Braun, M. T. (2013). Obstacles to social networking website use among older adults. *Computers in Human Behavior*, 29(3), 673–680. 0747-5632. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0747563212003330>
- Bravo, G., Paquet, M., & Dubois, M.-F. (2003). Opinions regarding who should consent to research on behalf of an older adult suffering from dementia. *Dementia*, 2(1), 49–65. doi:10.1177/1471301203002001994. eprint: <http://dem.sagepub.com/content/2/1/49.full.pdf+html>
- Brooker, D. & Duce, L. (2000). Wellbeing and activity in dementia: a comparison of group reminiscence therapy, structured goal-directed group activity and unstructured time. *Aging & Mental Health*, 4(4), 354–358. doi:10.1080/713649967. eprint: <http://dx.doi.org/10.1080/713649967>
- Buchanan, A. (2004). Mental capacity, legal competence and consent to treatment. *Journal of the Royal Society of Medicine*, 97(9), 415–420. eprint: <http://jrs.sagepub.com/content/97/9/415.full.pdf+html>. Retrieved from <http://jrs.sagepub.com/content/97/9/415.abstract>
- Burns, P., Jones, S. C., Iverson, D. O. N., & Caputi, P. (2013). Usability testing of asthmawise with older adults. *Computers Informatics Nursing*, 31(5), 219–226. 1538-2931. Retrieved from [http://journals.lww.com/cinjournal/Fulltext/2013/05000/Usability\\_Testing\\_of\\_AsthmaWise\\_With\\_Older\\_Adults.5.aspx](http://journals.lww.com/cinjournal/Fulltext/2013/05000/Usability_Testing_of_AsthmaWise_With_Older_Adults.5.aspx)
- Butler, R. N. (1963). The life review: an interpretation of reminiscence in the aged. *Psychiatry*, 26(1), 65–76. doi:10.1521/00332747.1963.11023339. eprint: <http://www.tandfonline.com/doi/pdf/10.1521/00332747.1963.11023339>
- Calero Valdez, A., Ziefle, M., Horstmann, A., Herding, D., & Schroeder, U. (2009). Effects of aging and domain knowledge on usability in small screen devices for diabetes patients. In A. Holzinger & K. Miesenberger (Eds.), *Hci and usability for e-inclusion* (Vol. 5889, pp. 366–386). Lecture Notes in Computer Science. 978-3-642-10307-0. Berlin: Springer Berlin Heidelberg. Retrieved from [http://dx.doi.org/10.1007/978-3-642-10308-7\\_26](http://dx.doi.org/10.1007/978-3-642-10308-7_26)
- Callari, T. C., Ciairano, S., & Re, A. (2012). Elderly-technology interaction: accessibility and acceptability of technological devices promoting motor and cognitive training. *Work: A Journal of Prevention, Assessment and Rehabilitation*, 41(S1), 362–369. doi:10.3233/WOR-2012-0183-362
- Cameron, D. (2012). Transcript: prime minister's speech to the dementia 2012 conference. Retrieved from <http://www.number10.gov.uk/news/transcript-prime-ministers-speech-to-the-dementia-2012-conference/>

- Cappeliez, P., Guindon, M., & Robitaille, A. (2008). Functions of reminiscence and emotional regulation among older adults. *Journal of Aging Studies*, 22(3), 266–272. doi:<http://dx.doi.org/10.1016/j.jaging.2007.06.003>
- Cappeliez, P., O'Rourke, N., & Chaudhury, H. (2005). Functions of reminiscence and mental health in later life. *Aging & Mental Health*, 9(4), 295–301. PMID: 16019284. doi:10.1080/13607860500131427. eprint: <http://dx.doi.org/10.1080/13607860500131427>
- Cappeliez, P. & O'Rourke, N. (2002). Personality traits and existential concerns as predictors of the functions of reminiscence in older adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 57(2), P116–P123. doi:10.1093/geronb/57.2.P116. eprint: <http://psychogerontology.oxfordjournals.org/content/57/2/P116.full.pdf+html>
- Cappeliez, P. & O'Rourke, N. (2006). Empirical validation of a model of reminiscence and health in later life. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 61(4), P237–P244. eprint: <http://psychogerontology.oxfordjournals.org/content/61/4/P237.full.pdf+html>. Retrieved from <http://psychogerontology.oxfordjournals.org/content/61/4/P237.abstract>
- Cappeliez, P., Rivard, V., & Guindon, S. (2007). Functions of reminiscence in later life: proposition of a model and applications. *European Review of Applied Psychology*, 57(3), 151–156. Psychologie du vieillissement : prise en charge et adaptation. doi:<http://dx.doi.org/10.1016/j.erap.2005.02.014>
- Cassell, E. J. (2000). The principles of the belmont report revisited: how have respect for persons, beneficence, and justice been applied to clinical medicine? *Hastings Center Report*, 30(4), 12–21. doi:10.2307/3527640
- Castilla, D., Garcia-Palacios, A., Bretón-López, J., Miralles, I., Baños, R. M., Etchemendy, E., ... Botella, C. (2013). Process of design and usability evaluation of a telepsychology web and virtual reality system for the elderly: butler. *International Journal of Human-Computer Studies*, 71(3), 350–362. 1071-5819. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1071581912001772>
- Chaiwoo, L., Orszulak, J., Myrick, R., Coughlin, J. F., de Weck, O. L., & Asai, D. (2011). Integration of medication monitoring and communication technologies in designing a usability-enhanced home solution for older adults. In *2011 international conference on ict convergence (ictc)* (pp. 390–395). 28th - 30th September 2011.
- Chan, C. C. H., Wong, A. W. K., Lee, T. M. C., & Chi, I. (2009). Modified automatic teller machine prototype for older adults: a case study of participative approach to inclusive design. *Applied Ergonomics*, 40(2), 151–160. 0003-6870. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0003687008000586>
- Chao, S.-Y., Liu, H.-Y., Wu, C.-Y., Jin, S.-F., Chu, T.-L., Huang, T.-S., & Clark, M. J. (2006). The effects of group reminiscence therapy on depression, self esteem, and life satisfaction of elderly

- nursing home residents. *Journal of Nursing Research*, 14(1). doi:10.1097/01.JNR.0000387560.03823.c7
- Charness, N. & Boot, W. R. (2009). Aging and information technology use: potential and barriers. *Current Directions in Psychological Science*, 18(5), 253–258. 10.1111/j.1467-8721.2009.01647.x. Retrieved from <http://cdp.sagepub.com/content/18/5/253.abstractN2>
- Chen, C., Takahashi, T., & Yang, S. (2015). Remembrance of happy things past: positive autobiographical memories are intrinsically rewarding and valuable, but not in depression. *Frontiers in Psychology*, 6, 222. doi:10.3389/fpsyg.2015.00222
- Chen, K. & Chan, A. H. S. (2011). A review of technology acceptance by older adults. *Gerontechnology*, 10(1), 1–12. Retrieved from <http://www.gerontechnology.info/index.php/journal/article/view/gt.2011.10.01.006.00>
- Chen, K. & Chan, A. H. S. (2013). Use or non-use of gerontechnology—a qualitative study. *International Journal of Environmental Research and Public Health*, 10(10), 4645–4666. 1660-4601 Chen, Ke Chan, Alan Hoi-Shou Journal Article Switzerland Int J Environ Res Public Health. 2013 Sep 30;10(10):4645-66. doi: 10.3390/ijerph10104645. doi:10.3390/ijerph10104645
- Chen, K. & Chan, A. H. S. (2014). Predictors of gerontechnology acceptance by older hong kong chinese. *Technovation*, 34(2), 126–135. 0166-4972. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0166497213001156>
- Chen, K., Chan, A. H. S., & Tsang, S. N. H. (2013). Usage of mobile phones amongst elderly people in hong kong. In *International multiconference of engineers & computer scientists 2013*. 96697265 Proceedings of the International MultiConference of Engineers & Computer Scientists 2013. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=edo&AN=96697265&site=eds-live>
- Chevalier, A., Dommès, A., & Martins, D. (2013). The effects of ageing and website ergonomic quality on internet information searching. *Ageing & Society*, 33(6), 1009–1035. doi:doi:10.1017/S0144686X12000323
- Chou, W. H., Lai, Y.-T., & Liu, K.-H. (2012). User requirements of social media for the elderly: a case study in taiwan. *Behaviour & Information Technology*, 32(9), 920–937. doi: 10.1080/0144929X.2012.681068 0144-929X. Retrieved from <http://dx.doi.org/10.1080/0144929X.2012.681068>
- Chueh, K.-H. & Chang, T.-Y. (2014). Effectiveness of group reminiscence therapy for depressive symptoms in male veterans: 6-month follow-up. *International Journal of Geriatric Psychiatry*, 29(4), 377–383. doi:10.1002/gps.4013
- Chun, Y. J. & Patterson, P. E. (2012a). A suggestion for future research on interface design of an internet-based telemedicine system for the elderly. *Work: A Journal of Prevention, Assessment and Rehabilitation*, 41(S1), 353–356. Retrieved from <http://dx.doi.org/10.3233/WOR-2012-0181-353>



- Chun, Y. J. & Patterson, P. E. (2012b). A usability gap between older adults and younger adults on interface design of an internet-based telemedicine system. *Work: A Journal of Prevention, Assessment and Rehabilitation*, 41(S1), 349–352. Retrieved from <http://dx.doi.org/10.3233/WOR-2012-0180-349>
- Chung, J. C. C. (2009). An intergenerational reminiscence programme for older adults with early dementia and youth volunteers: values and challenges. *Scandinavian Journal of Caring Sciences*, 23(2), 259–264. doi:10.1111/j.1471-6712.2008.00615.x
- Cohen-Mansfield, J., Marx, M. S., Dakheel-Ali, M., Regier, N. G., & Thein, K. (2010). Can persons with dementia be engaged with stimuli? *The American Journal of Geriatric Psychiatry*, 18(4), 351–362. doi:<http://dx.doi.org/10.1097/JGP.0b013e3181c531fd>
- Cohen-Mansfield, J., Marx, M. S., Dakheel-Ali, M., Regier, N. G., Thein, K., & Freedman, L. (2010). Can agitated behavior of nursing home residents with dementia be prevented with the use of standardized stimuli? *Journal of the American Geriatrics Society*, 58(8), 1459–1464. doi:10.1111/j.1532-5415.2010.02951.x
- Cohen-Mansfield, J., Marx, M. S., Thein, K., & Dakheel-Ali, M. (2010). The impact of past and present preferences on stimulus engagement in nursing home residents with dementia. *Aging & Mental Health*, 14(1), 67–73. PMID: 20155522. doi:10.1080/13607860902845574. eprint: <http://dx.doi.org/10.1080/13607860902845574>
- Cohen-Mansfield, J., Thein, K., Dakheel-Ali, M., & Marx, M. S. (2010). The underlying meaning of stimuli: impact on engagement of persons with dementia. *Psychiatry Research*, 177(1?2), 216–222. doi:<http://dx.doi.org/10.1016/j.psychres.2009.02.010>
- Coleman, P. G. (2005). Uses of reminiscence: functions and benefits. *Aging & Mental Health*, 9(4), 291–294. PMID: 16019283. doi:10.1080/13607860500169641. eprint: <http://dx.doi.org/10.1080/13607860500169641>
- Coluccia, E., Bianco, C., & Brandimonte, M. A. (2010). Autobiographical and event memories for surprising and unsurprising events. *Applied Cognitive Psychology*, 24(2), 177–199. doi:10.1002/acp.1549
- Cotelli, M., Manenti, R., & Zanetti, O. (2012). Reminiscence therapy in dementia: a review. *Maturitas*, 72(3), 203–205. doi:<http://dx.doi.org/10.1016/j.maturitas.2012.04.008>
- Crossland, M. D. & Rubin, G. S. (2012). Text accessibility by people with reduced contrast sensitivity. *Optometry & Vision Science*, 89(9), 1276–1281. 1040-5488. Retrieved from [http://journals.lww.com/optvissci/Fulltext/2012/09000/Text\\_Accessibility\\_by\\_People\\_with\\_Reduced\\_Contrast.9.aspx](http://journals.lww.com/optvissci/Fulltext/2012/09000/Text_Accessibility_by_People_with_Reduced_Contrast.9.aspx)
- Czaja, S. J., Sharit, J., Lee, C. C., Nair, S. N., Hernández, M. A., Arana, N., & Fu, S. H. (2013). Factors influencing use of an e-health website in a community sample of older adults. *Journal of the American Medical Informatics Association*, 20(2), 277–284. 10.1136/amiajnl-2012-000876. Retrieved from <http://jamia.bmj.com/content/20/2/277.abstract>

- de Sant'Anna, M., Vallet, C., Kadouche, R., Stefanucci, D., Tomascakova, A., Morat, B., & Rigaud, A. S. (2010). Computer accessibility for individuals suffering from mild to moderate alzheimer's disease. *European Geriatric Medicine*, 1(3), 186–192. 1878-7649. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1878764910001117>
- Demiray, B. & Freund, A. M. (2015). Michael jackson, bin laden and i: functions of positive and negative, public and private flashbulb memories. *Memory*, 23(4), 487–506. PMID: 24758437. doi:10.1080/09658211.2014.907428. eprint: <http://dx.doi.org/10.1080/09658211.2014.907428>
- Dempsey, L., Murphy, K., Cooney, A., Casey, D., O'Shea, E., Devane, D., ... Hunter, A. (2014). Reminiscence in dementia: a concept analysis. *Dementia*, 13(2), 176–192. doi:10.1177/1471301212456277. eprint: <http://dem.sagepub.com/content/13/2/176.full.pdf+html>
- Department for Constitutional Affairs. (2007). Mental capacity act 2005 code of practice. Retrieved from [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/497253/Mental-capacity-act-code-of-practice.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/497253/Mental-capacity-act-code-of-practice.pdf)
- Dewing, J. (2007). Participatory research: a method for process consent with persons who have dementia. *Dementia*, 6(1), 11–25. doi:10.1177/1471301207075625. eprint: <http://dem.sagepub.com/content/6/1/11.full.pdf+html>
- Dickinson, A., Eisma, R., & Gregor, P. (2011). The barriers that older novices encounter to computer use. *Universal Access in the Information Society*, 10(3), 261–266. Univ Access Inf Soc 1615-5289. Retrieved from <http://dx.doi.org/10.1007/s10209-010-0208-6>
- Dodge, R., Daly, A. P., Huyton, J., & Sanders, L. D. (2012). The challenge of defining wellbeing. *International Journal of Wellbeing*, 2(3).
- Dogruel, L., Joeckel, S., & Bowman, N. D. (2012). Analyzing influencing factors on elderly people's perceived ease of use of interactive media. In *2012 international communication association annual meeting, information systems division* (pp. 1–26). Article Accession Number: 85900301; Issue Info: 2012 Annual Meeting, p1; Number of Pages: 26p; Document Type: Article. International Communication Association. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=ufh&AN=85900301&site=eds-live>
- Etcheverry, I., Terrier, P., & Marquié, J. C. (2012). Are older adults less efficient in making attributions about the origin of memories for web interaction? *Recent advances in Human information search behavior*, 62(2), 93–102. 1162-9088. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1162908811000193>
- Faucounau, V., Wu, Y. -.-H., Boulay, M., Rotrou, J., & Rigaud, A. -.-S. (2010). Cognitive intervention programmes on patients affected by mild cognitive impairment: a promising intervention tool for mci? *The journal of nutrition, health & aging*, 14(1), 31–35. doi:10.1007/s12603-010-0006-0
- Fisk, J. D., Beattie, B. L., & Donnelly, M. (2007). Ethical considerations for decision making for treatment and research participation. *Alzheimer's & Dementia*, 3(4), 411–417. doi:<http://dx.doi.org/10.1016/j.jalz.2007.08.001>

- for the Protection of Human Subjects of Biomedical, N. C. & Research, B. (1979). The belmont report. Retrieved from <http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.html>
- Fromme, E., Kenworthy-Heinige, T., & Hribar, M. (2011). Developing an easy-to-use tablet computer application for assessing patient-reported outcomes in patients with cancer. *Supportive Care in Cancer*, 19(6), 815–822. Support Care Cancer 0941-4355. Retrieved from <http://dx.doi.org/10.1007/s00520-010-0905-y>
- Garrett, J. J. (2010). *The elements of user experience: user-centered design for the web and beyond* (2nd). Thousand Oaks, CA, USA: New Riders Publishing.
- Gatsou, C., Politis, A., & Zevgolits, D. (2011). Text vs visual metaphor in mobile interfaces for novice user interaction. *Information Services and Use*, 31(3), 271–279. Retrieved from <http://dx.doi.org/10.3233/ISU-2012-0657>
- Gatto, S. L. & Tak, S. H. (2008). Computer, internet, and e-mail use among older adults: benefits and barriers. *Educational Gerontology*, 34(9), 800–811. doi: 10.1080/03601270802243697 0360-1277. Retrieved from <http://dx.doi.org/10.1080/03601270802243697>
- Gilly, M. C., Celsi, M. W., & Schau, H. J. (2012). It don't come easy: overcoming obstacles to technology use within a resistant consumer group. *Journal of Consumer Affairs*, 46(1), 62–89. 1745-6606. Retrieved from <http://dx.doi.org/10.1111/j.1745-6606.2011.01218.x>
- Gonzalez, J., Mayordomo, T., Torres, M., Sales, A., & Melendez, J. C. (2015, June). Reminiscence and dementia: a therapeutic intervention. *International Psychogeriatrics, FirstView*, 1–7. doi:10.1017/S1041610215000344
- Goodwin, C. L. (2013). Use of the computer and the internet by well older adults. *Activities, Adaptation & Aging*, 37(1), 63–78. doi: 10.1080/01924788.2012.729186 0192-4788. Retrieved from <http://dx.doi.org/10.1080/01924788.2012.729186>
- Gowans, G., Campbell, J., Alm, N., Dye, R., Astell, A., & Ellis, M. (2004). Designing a multimedia conversation aid for reminiscence therapy in dementia care environments. In *Chi '04 extended abstracts on human factors in computing systems* (pp. 825–836). CHI EA '04. Vienna, Austria: ACM. doi:10.1145/985921.985943
- Granata, C., Pino, M., Legouverneur, G., Vidal, J. S., Bidaud, P., & Rigaud, A. S. (2013). Robot services for elderly with cognitive impairment: testing usability of graphical user interfaces. *Technology and Health Care*, 21(3), 217–231. Retrieved from <http://dx.doi.org/10.3233/THC-130718>
- Grasel, E., Wiltfang, J., & Kornhuber, J. (2003). Non-drug therapies for dementia: an overview of the current situation with regard to proof of effectiveness. *Dementia and Geriatric Cognitive Disorders*, 15(3), 115–125.
- Greengard, S. (2009). Facing an age-old problem. *Communications of the ACM*, 52(9), 20–22. doi:10.1145/1562164.1562173
- Greenhalgh, T., Wherton, J., Sugarhood, P., Hinder, S., Procter, R., & Stones, R. (2013). What matters to older people with assisted living needs? a phenomenological analysis of the use and non-use

- of telehealth and telecare. *Social Science & Medicine*, 93, 86–94. 0277-9536. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0277953613003304>
- Haight, B. K., Bachman, D. L., Hendrix, S., Wagner, M. T., Meeks, A., & Johnson, J. (2003). Life review: treating the dyadic family unit with dementia. *Clinical Psychology & Psychotherapy*, 10(3), 165–174. doi:10.1002/cpp.367
- Hakkarainen, P. (2012). 'no good for shovelling snow and carrying firewood': social representations of computers and the internet by elderly finnish non-users. *New Media & Society*, 14(7), 1198–1215. 10.1177/1461444812442663.
- Halfpenny, P. (2014). *Positivism and sociology : explaining social life*. Florence, KY, USA: Taylor and Francis. Retrieved from <http://site.ebrary.com/lib/portsmouth/docDetail.action?docID=10913350>
- Hallford, D. & Mellor, D. (2013). Reminiscence-based therapies for depression: should they be used only with older adults? *Clinical Psychology: Science and Practice*, 20(4), 452–468. doi:10.1111/cpsp.12043
- Hanson, V. L. (2010). Influencing technology adoption by older adults. *Interacting with Computers*, 22(6), 502–509. 10.1016/j.intcom.2010.09.001.
- Hara, Y. & Kashimura, K. (2010). Cognitive aging and rich internet applications: usability problems of ajax based on the empirical study of older adults. *Japanese Psychological Research*, 52(3), 216–226. 1468-5884. Retrieved from <http://dx.doi.org/10.1111/j.1468-5884.2010.00439.x>
- Harada, E. T., Mori, K., & Taniue, N. (2010). Cognitive aging and the usability of it-based equipment: learning is the key. *Japanese Psychological Research*, 52(3), 227–243. 1468-5884. Retrieved from <http://dx.doi.org/10.1111/j.1468-5884.2010.00440.x>
- Hart, T. A., Chaparro, B. S., & Halcomb, C. G. (2008). Evaluating websites for older adults: adherence to 'senior-friendly' guidelines and end-user performance. *Behaviour & Information Technology*, 27(3), 191–199. doi: 10.1080/01449290600802031 0144-929X. Retrieved from <http://dx.doi.org/10.1080/01449290600802031>
- Hasegawa, S., Miyao, M., Matsunuma, S., Fujikake, K., & Omori, M. (2008). Effects of aging and display contrast on the legibility of characters on mobile phone screens. *International Journal of Interactive Mobile Technologies*, 2(4), 7–12. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=iih&AN=34706145&site=ehost-live>
- Haslam, C., Haslam, S. A., Jetten, J., Bevins, A., Ravenscroft, S., & Tonks, J. (2010). The social treatment: the benefits of group interventions in residential care settings. *Psychology and Aging*, 25(1), 157–167. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=pdh&AN=2010-04859-014&site=ehost-live>
- Heart, T. & Kalderon, E. (2013). Older adults: are they ready to adopt health-related ict? *International Journal of Medical Informatics*, 82(11), e209–e231. 1386-5056. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1386505611000682>

- Hernández-Encuentra, E., Pousada, M., & Gómez-Zúñiga, B. (2009). Ict and older people: beyond usability. *Educational Gerontology*, 35(3), 226–245. doi: 10.1080/03601270802466934 0360-1277. Retrieved from <http://dx.doi.org/10.1080/03601270802466934>
- Hertzum, M. & Hornbæk, K. (2010). How age affects pointing with mouse and touchpad: a comparison of young, adult, and elderly users. *International Journal of Human-Computer Interaction*, 26(7), 703–734. doi: 10.1080/10447318.2010.487198 1044-7318. Retrieved from <http://dx.doi.org/10.1080/10447318.2010.487198>
- Higgins, P. G. & Glasgow, A. (2012). Development of guidelines for designing appliances for older persons. *Work: A Journal of Prevention, Assessment and Rehabilitation*, 41(S1), 333–339. Retrieved from <http://dx.doi.org/10.3233/WOR-2012-0178-333>
- Hollinworth, N. & Hwang, F. (2010). Relating computer tasks to existing knowledge to improve accessibility for older adults. Conference Paper. ACM. doi:10.1145/1878803.1878830
- Holzinger, A., Ziefle, M., & Röcker, C. (2010). Human-computer interaction and usability engineering for elderly (hci4aging): introduction to the special thematic session. In K. Miesenberger, J. Klaus, W. Zagler, & A. Karshmer (Eds.), *Computers helping people with special needs* (Vol. 6180, pp. 556–559). Lecture Notes in Computer Science. 978-3-642-14099-0. Berlin: Springer Berlin Heidelberg. Retrieved from <http://dx.doi.org/10.1007/978-3-642-14100-3.83>
- Hough, M. & Kobylanski, A. (2009). Increasing elder consumer interactions with information technology. *Journal of Consumer Marketing*, 26(1), 39–48. doi: 10.1108/07363760910927037 0736-3761. Retrieved from <http://www.emeraldinsight.com/doi/abs/10.1108/07363760910927037>
- Houghton, C., Hunter, A., & Meskill, P. (2012, 2016/01/14). Linking aims, paradigm and method in nursing research. *Nurse Researcher*, 20(2), 34–39. doi:10.7748/nr2012.11.20.2.34.c9439
- Hsieh, C.-J., Chang, C., Su, S.-F., Hsiao, Y.-L., Shih, Y.-W., Han, W.-H., & Lin, C.-C. (2010). Reminiscence group therapy on depression and apathy in nursing home residents with mild-to-moderate dementia. *Journal of Experimental & Clinical Medicine*, 2(2), 72–78. doi:[http://dx.doi.org/10.1016/S1878-3317\(10\)60012-5](http://dx.doi.org/10.1016/S1878-3317(10)60012-5)
- Hwang, A. S., Truong, K. N., & Mihailidis, A. (2012). Using participatory design to determine the needs of informal caregivers for smart home user interfaces. In *2012 6th international conference on pervasive computing technologies for healthcare (pervasivehealth)* (pp. 41–48). 21-24 May 2012.
- Hwang, M.-Y., Hong, J.-C., Hao, Y.-w., & Jong, J.-T. (2011). Elders' usability, dependability, and flow experiences on embodied interactive video games. *Educational Gerontology*, 37(8), 715–731. doi: 10.1080/03601271003723636 0360-1277. Retrieved from <http://dx.doi.org/10.1080/03601271003723636>
- Hwang, M.-Y., Hong, J.-C., Jong, J.-T., Lee, C.-K., & Chang, H.-Y. (2009). From fingers to embodiment: a study on the relations of the usability, dependability of the embodied interactive video games and the elders' flow experience. In M. Chang, R. Kuo, Kinshuk, G.-D. Chen, & M. Hirose

- (Eds.), *Learning by playing. game-based education system design and development* (Vol. 5670, pp. 464–472). Lecture Notes in Computer Science. 978-3-642-03363-6. Berlin: Springer Berlin Heidelberg. Retrieved from [http://dx.doi.org/10.1007/978-3-642-03364-3\\_55](http://dx.doi.org/10.1007/978-3-642-03364-3_55)
- Hwang, Y.-C. (2011). A study on healthcare support e-service design for senior citizens. *Journal of Computers*, 6(3), 397–403. Retrieved from <http://ojs.academypublisher.com/index.php/jcp/article/view/3898>
- Ji, Y. G., Choi, J., Lee, J. Y., Han, K. H., Kim, J., & Lee, I.-K. (2010). Older adults in an aging society and social computing: a research agenda. *International Journal of Human-Computer Interaction*, 26(11-12), 1122–1146. doi: 10.1080/10447318.2010.516728 1044-7318. Retrieved from <http://dx.doi.org/10.1080/10447318.2010.516728>
- Jo, H. & Song, E. (2015). The effect of reminiscence therapy on depression, quality of life, ego-integrity, social behavior function, and activities of daily living in elderly patients with mild dementia. *Educational Gerontology*, 41(1), 1–13. doi:10.1080/03601277.2014.899830. eprint: <http://dx.doi.org/10.1080/03601277.2014.899830>
- Jones, T., Kay, D., Upton, P., & Upton, D. (2013). An evaluation of older adults use of ipads in eleven uk care-homes. 5(3), 62–76. doi:10.4018/jmhci.2013070104
- Jung, A. K., Kyung-Kyu, K., Hyun-Roc, Y., & Dongho, K. (2009). A sensory gate-ball game for the aged people and its user interface design. In *Conference on games and virtual worlds for serious applications, 2009 (vs-games '09)* (pp. 111–116). 23-24 March 2009.
- Karlsson, E., Axelsson, K., Zingmark, K., & Savenstedt, S. (2011). The challenge of coming to terms with the use of a new digital assistive device: a case study of two persons with mild dementia. *The Open Nursing Journal*, 5, 102–10. 1874-4346 Karlsson, Eva Axelsson, Karin Zingmark, Karin Savenstedt, Stefan Journal Article Netherlands Open Nurs J. 2011;5:102-10. doi: 10.2174/18744346011050100102. Epub 2011 Nov 4. doi:10.2174/18744346011050100102
- Koppel, J. & Berntsen, D. (2016). The reminiscence bump in autobiographical memory and for public events: a comparison across different cueing methods. *Memory*, 24(1), 44–62. PMID: 25529327. doi:10.1080/09658211.2014.985233. eprint: <http://dx.doi.org/10.1080/09658211.2014.985233>
- Korte, J., Bohlmeijer, E. T., Westerhof, G. J., & Pot, A. M. (2011). Reminiscence and adaptation to critical life events in older adults with mild to moderate depressive symptoms. *Aging & Mental Health*, 15(5), 638–646. PMID: 21815856. doi:10.1080/13607863.2010.551338
- Kuo, H.-M., Chen, C.-W., & Hsu, C.-H. (2012). A study of a b2c supporting interface design system for the elderly. *Human Factors and Ergonomics in Manufacturing & Service Industries*, 22(6), 528–540. 1520-6564. Retrieved from <http://dx.doi.org/10.1002/hfm.20297>
- Lai, C. K. Y., Chi, I., & Kayser-Jones, J. (2004, March). A randomized controlled trial of a specific reminiscence approach to promote the well-being of nursing home residents with dementia. *International Psychogeriatrics*, 16(1), 33–49. doi:10.1017/S1041610204000055

- Lam, S. & Chung, W. (2009). Understanding the need of mobile ict learning as an elderly learning tool. *International Journal of Emerging Technologies in Learning (iJET)*, 4(4), 35–40.
- Lam, S. & Chung, W. (2010). Uses of internet and mobile technology in health systems for the elderly. *International Journal of Interactive Mobile Technologies*, 4(2), 40–47. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=iih&AN=49074485&site=ehost-live>
- Langdon, P. & Thimbleby, H. (2010). Inclusion and interaction: designing interaction for inclusive populations. *Interacting with Computers*, 22(6), 439–448. 10.1016/j.intcom.2010.08.007. Retrieved from <http://iwc.oxfordjournals.org/content/22/6/439.short>
- Lange, M. M., Rogers, W., & Dodds, S. (2013). Vulnerability in research ethics: a way forward. *Bioethics*, 27(6), 333–340. doi:10.1111/bioe.12032
- Lazar, A., Thompson, H., & Demiris, G. (2014). A systematic review of the use of technology for reminiscence therapy. *Health Education & Behavior*, 41(1 suppl), 51S–61S. doi:10.1177/1090198114537067. eprint: [http://heb.sagepub.com/content/41/1\\_suppl/51S.full.pdf+html](http://heb.sagepub.com/content/41/1_suppl/51S.full.pdf+html)
- Leigh, S. & Flatt, S. (2015). App-based psychological interventions: friend or foe? *Evidence Based Mental Health*, 18(4), 97–99. doi:10.1136/eb-2015-102203. eprint: <http://ebmh.bmj.com/content/18/4/97.full.pdf+html>
- Leikas, J. & Saariluoma, P. (2008). 'worth' and mental contents in designing for ageing citizens' form of life. *Gerontechnology*, 7(3), 305–318. Retrieved from <http://gerontechnology.info/index.php/journal/article/view/945>
- Leung, R., McGrenere, J., & Graf, P. (2009). Age-related differences in the initial usability of mobile device icons. *Behaviour & Information Technology*, 30(5), 629–642. doi: 10.1080/01449290903171308 0144-929X. Retrieved from <http://dx.doi.org/10.1080/01449290903171308>
- Li, H., Rau, P.-L. P., Fujimura, K., Gao, Q., & Wang, L. (2012). Designing effective web forms for older web users. *Educational Gerontology*, 38(4), 271–281. doi: 10.1080/03601277.2010.544578 0360-1277. Retrieved from <http://dx.doi.org/10.1080/03601277.2010.544578>
- Lin, C. A., Neafsey, P. J., & Strickler, Z. (2009). Usability testing by older adults of a computer-mediated health communication program. *Journal of Health Communication*, 14(2), 102–118. doi: 10.1080/10810730802659095 1081-0730. Retrieved from <http://dx.doi.org/10.1080/10810730802659095>
- Logue, M. D. & Effken, J. A. (2012). An exploratory study of the personal health records adoption model in the older adult with chronic illness. *Informatics in Primary Care*, 20(3), 151–169. Retrieved from <http://www.ingentaconnect.com/content/bcs/ipc/2012/00000020/00000003/art00002>
- Lorenz, A. & Oppermann, R. (2009). Mobile health monitoring for the elderly: designing for diversity. *Pervasive and Mobile Computing*, 5(5), 478–495. 1574-1192. Retrieved from <http://www.sciencedirect.com/science/article/pii/S157411920800093X>

- MacKinlay, E. & Trevitt, C. (2010). Living in aged care: using spiritual reminiscence to enhance meaning in life for those with dementia. *International Journal of Mental Health Nursing*, 19(6), 394–401. doi:10.1111/j.1447-0349.2010.00684.x
- Mahmud, N., Vogt, J., Luyten, K., Slegers, K., Van den Bergh, J., & Coninx, K. (2010). Dazed and confused considered normal: an approach to create interactive systems for people with dementia. In R. Bernhaupt, P. Forbrig, J. Gulliksen, & M. Lárusdóttir (Eds.), *Human-centred software engineering* (Vol. 6409, pp. 119–134). Lecture Notes in Computer Science. 978-3-642-16487-3. Berlin: Springer Berlin Heidelberg. Retrieved from [http://dx.doi.org/10.1007/978-3-642-16488-0\\_10](http://dx.doi.org/10.1007/978-3-642-16488-0_10)
- Mahoney, E. L. & Mahoney, D. F. (2010). Acceptance of wearable technology by people with alzheimer's disease: issues and accommodations. *American Journal of Alzheimer's Disease and Other Dementias*, 25(6), 527–531. 10.1177/1533317510376944. Retrieved from <http://aja.sagepub.com/content/25/6/527.abstract>
- Matlabi, H., Parker, S. G., & McKee, K. (2012). Experiences of extra care housing residents aged fifty-five and over with home-based technology. *Social Behavior and Personality: An International Journal*, 40(2), 293–300. doi:10.2224/sbp.2012.40.2.293. Retrieved from <http://dx.doi.org/10.2224/sbp.2012.40.2.293>
- Mazzoni, G., Vannucci, M., & Batool, I. (2014). Manipulating cues in involuntary autobiographical memory: verbal cues are more effective than pictorial cues. *Memory & Cognition*, 42(7), 1076–1085. doi:10.3758/s13421-014-0420-3
- McKenzie, B., Bowen, M. E., Keys, K., & Bulat, T. (2013). Safe home program: a suite of technologies to support extended home care of persons with dementia. *American Journal of Alzheimer's Disease and Other Dementias*, 28(4), 348–354. 10.1177/1533317513488917.
- Meiland, F. J. M., Bouman, A. I. E., Sävenstedt, S., Bentvelzen, S., Davies, R. J., Mulvenna, M. D., ... Dröes, R.-M. (2012). Usability of a new electronic assistive device for community-dwelling persons with mild dementia. *Aging & Mental Health*, 16(5), 584–591. doi: 10.1080/13607863.2011.651433 1360-7863. Retrieved from <http://dx.doi.org/10.1080/13607863.2011.651433>
- Mertens, A., Brandl, C., Przybysz, P., Koch-Körffges, D., & Schlick, C. M. (2012). Design recommendations for the creation of icons for the elderly. *Work: A Journal of Prevention, Assessment and Rehabilitation*, 41(S1), 3519–3525. Retrieved from <http://dx.doi.org/10.3233/WOR-2012-0630-3519>
- Meza-Kubo, V. & Moran, A. L. (2013). Ucsa: a design framework for usable cognitive systems for the worried-well. *Personal and Ubiquitous Computing*, 17(6), 1135–1145. doi:10.1007/s00779-012-0554-x
- Michaud, F., Boissy, P., Labonté, D., Brière, S., Perreault, K., Corriveau, H., ... Létourneau, D. (2010). Exploratory design and evaluation of a homecare teleassistive mobile robotic system.



- Mechatronics*, 20(7), 751–766. 0957-4158. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0957415810000280>
- Mihailidis, A., Blunsden, S., Boger, J., Richards, B., Zutis, K., Young, L., & Hoey, J. (2010). Towards the development of a technology for art therapy and dementia: definition of needs and design constraints. *The Arts in Psychotherapy*, 37(4), 293–300. 0197-4556. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0197455610000663>
- Miller, D., Gagnon, M., Talbot, V., & Messier, C. (2013). Predictors of successful communication with interactive voice response systems in older people. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 68(4), 495–503. 10.1093/geronb/gbs092.
- Mitzner, T. L., Boron, J. B., Fausset, C. B., Adams, A. E., Charness, N., Czaja, S. J., . . . Sharit, J. (2010). Older adults talk technology: technology usage and attitudes. *Computers in Human Behavior*, 26(6), 1710–1721. 0747-5632. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0747563210001925>
- Money, A. G., Fernando, S., Lines, L., & Elliman, A. D. (2009). Developing and evaluating web-based assistive technologies for older adults. *Gerontechnology*, 8(3), 165–177. Retrieved from <http://gerontechnology.info/index.php/journal/article/view/1038>
- Monroe, T. B., Herr, K. A., Mion, L. C., & Cowan, R. L. (2013). Ethical and legal issues in pain research in cognitively impaired older adults. *International Journal of Nursing Studies*, 50(9), 1283–1287. Special Issue Improving the Care of Older Persons. doi:<http://dx.doi.org/10.1016/j.ijnurstu.2012.11.023>
- Mulvenna, M., Doyle, L., Wright, T., Zheng, H., Topping, P., Boyle, K., & Martin, S. (2011). Evaluation of card-based versus device-based reminiscing using photographic images. *Journal of CyberTherapy & Rehabilitation*, 1(4), 57–66.
- Murray, A. (2013). The mental capacity act and dementia research. *Nursing Older People*, 25(3), 14–20. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=86727935&site=ehost-live>
- Nagle, S. & Schmidt, L. (2012). Computer acceptance of older adults. *Work: A Journal of Prevention, Assessment and Rehabilitation*, 41(S1), 3541–3548. Retrieved from <http://dx.doi.org/10.3233/WOR-2012-0633-3541>
- Nakamae, T., Yotsumoto, K., Tatsumi, E., & Hashimoto, T. (2014). Effects of productive activities with reminiscence in occupational therapy for people with dementia: a pilot randomized controlled study. *Hong Kong Journal of Occupational Therapy*, 24(1), 13–19. doi:<http://dx.doi.org/10.1016/j.hkjot.2014.01.003>
- Nandhakumar, J. & Jones, M. (1997). Too close for comfort? distance and engagement in interpretive information systems research. *Information Systems Journal*, 7(2), 109–131. doi:10.1046/j.1365-2575.1997.00013.x

- Nasir, M. H., Hassan, H., & Jomhari, N. (2008). The use of mobile phones by elderly: a study in malaysia perspectives. *Journal of Social Sciences*, 4(2), 123–127.
- Nasmith, W. & Parkinson, M. (2008). Senior citizens embrace change and make a new technology work for them. *The Electronic Library*, 26(5), 673–682. doi: 10.1108/02640470810910693 0264-0473. Retrieved from <http://www.emeraldinsight.com/doi/abs/10.1108/02640470810910693>
- Naumann, A. B., Wechsung, I., & Hurtienne, J. (2010). Multimodal interaction: a suitable strategy for including older users? *Interacting with Computers*, 22(6), 465–474. 0953-5438. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0953543810000706>
- Newell, A. F., Gregor, P., Morgan, M., Pullin, G., & Macaulay, C. (2011). User-sensitive inclusive design. *Universal Access in the Information Society*, 10(3), 235–243. Univ Access Inf Soc 1615-5289. Retrieved from <http://dx.doi.org/10.1007/s10209-010-0203-y>
- Nijhof, N., Gemert-Pijnen, J. E. W. C. v., Burns, C. M., & Seydel, E. R. (2013). A personal assistant for dementia to stay at home safe at reduced cost. *Gerontechnology*, 11(3), 469–479. Retrieved from <http://gerontechnology.info/index.php/journal/article/view/gt.2013.11.3.005.00>
- O'Brien, D., Knapp, R. B., Thompson, O., Craig, D., & Barrett, S. (2013). An exploration of seniors' motivation to use mobile brain-exercise software. *Gerontechnology*, 11(3), 436–444. Retrieved from <http://www.gerontechnology.info/index.php/journal/article/view/gt.2012.11.3.002.00>
- Office of National Statistics. (2012). Statistical bulletin: 2011 census: population estimates for the united kingdom, 27 march 2011. Retrieved from <http://www.ons.gov.uk/ons/rel/census/2011-census/population-and-household-estimates-for-the-united-kingdom/stb-2011-census--population-estimates-for-the-united-kingdom.html#tab-The-structure-of-the-population-of-the-United-Kingdom>
- Okumura, Y., Tanimukai, S., & Asada, T. (2008). Effects of short-term reminiscence therapy on elderly with dementia: a comparison with everyday conversation approaches. *Psychogeriatrics*, 8(3), 124–133. doi:10.1111/j.1479-8301.2008.00236.x
- Or, C. & Tao, D. (2012). Usability study of a computer-based self-management system for older adults with chronic diseases. *JMIR Research Protocols*, 1(2), e13. 1929-0748 Or, Calvin Tao, Da Journal Article Canada JMIR Res Protoc. 2012 Nov 8;1(2):e13. doi: 10.2196/resprot.2184. doi:10.2196/resprot.2184
- The Nuremberg Code. (2005). Retrieved from <http://www.hhs.gov/ohrp/archive/nurcode.html>
- Assessing mental capacity - bps guidelines published. (2006, April). *The Psychologist*, 19, 232.
- Visual Acuity. (2014). Retrieved from <http://precision-vision.com/Introduction-to-Visual-Acuity-Measurement/a-visualacuity.html#.Vof4AZOLTnQ>
- Fine Motor Control. (2015). Retrieved from <https://www.nlm.nih.gov/medlineplus/ency/article/002364.htm>
- Proxy. (2015). Retrieved from <http://dictionary.reference.com/browse/proxy>

- O'Rourke, J., Tobin, F., O'Callaghan, S., Sowman, R., & Collins, D. (2011). ?youtube?: a useful tool for reminiscence therapy in dementia? *Age and Ageing*, 40(6), 742–744. doi:10.1093/ageing/afr100. eprint: <http://ageing.oxfordjournals.org/content/40/6/742.full.pdf+html>
- Orpwood, R., Chadd, J., Howcroft, D., Sixsmith, A., Torrington, J., Gibson, G., & Chalfont, G. (2010). Designing technology to improve quality of life for people with dementia: user-led approaches. *Universal Access in the Information Society*, 9(3), 249–259. Univ Access Inf Soc 1615-5289. Retrieved from <http://dx.doi.org/10.1007/s10209-009-0172-1>
- O'Shea, E., Devane, D., Cooney, A., Casey, D., Jordan, F., Hunter, A., . . . Murphy, K. (2014). The impact of reminiscence on the quality of life of residents with dementia in long-stay care. *International Journal of Geriatric Psychiatry*, 29(10), 1062–1070. doi:10.1002/gps.4099
- Otake, K. (2015). Subjective happiness and autobiographical memory: differences in the ratio of positive events and transmission as emotional expression. *Personality and Individual Differences*, 72, 171–176. doi:<http://dx.doi.org/10.1016/j.paid.2014.08.046>
- Pak, R., Price, M. M., & Thatcher, J. (2009). Age-sensitive design of online health information: comparative usability study. *Journal of Medical Internet Research*, 11(4), e45. 1438-8871 Pak, Richard Price, Margaux M Thatcher, Jason Journal Article Research Support, Non-U.S. Gov't United States J Med Internet Res. 2009 Nov 16;11(4):e45. doi: 10.2196/jmir.1220. doi:10.2196/jmir.1220
- Pak, R. & Price, M. M. (2008). Designing an information search interface for younger and older adults. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 50(4), 614–628. 10.1518/001872008X312314. Retrieved from <http://hfs.sagepub.com/content/50/4/614.abstract>
- Pan, S. & Jordan-Marsh, M. (2010). Internet use intention and adoption among chinese older adults: from the expanded technology acceptance model perspective. *Computers in Human Behavior*, 26(5), 1111–1119. 0747-5632. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0747563210000555>
- Papa, F., Sapio, B., & Pelagalli, M. F. (2012). User experience with digital television: a qualitative investigation of young and elderly people. *International Journal of Digital Television*, 3(2), 197–211. doi:10.1386/jdtv.3.2.197\_1. Retrieved from [http://dx.doi.org/10.1386/jdtv.3.2.197\\_1](http://dx.doi.org/10.1386/jdtv.3.2.197_1)
- Patomella, A.-H., Kottorp, A., Malinowsky, C., & Nygård, L. (2011). Factors that impact the level of difficulty of everyday technology in a sample of older adults with and without cognitive impairment. *Technology and Disability*, 23(4), 243–250. Retrieved from <http://dx.doi.org/10.3233/TAD-2011-0331>
- Peeters, J. M., de Veer, A. J. E., van der Hoek, L., & Francke, A. L. (2012). Factors influencing the adoption of home telecare by elderly or chronically ill people: a national survey. *Journal of Clinical Nursing*, 21(21-22), 3183–3193. 1365-2702. Retrieved from <http://dx.doi.org/10.1111/j.1365-2702.2012.04173.x>

- Pijukkana, K. & Sahachaisaeree, N. (2012). Graphical design and functional perception on technology-driven products: case study on mobile usage of the elderly. *Procedia - Social and Behavioral Sciences*, 42, 264–270. 1877-0428 ASEAN Conference on Environment-Behaviour Studies (AcE-Bs), Riverside Majestic Hotel, 7- 8 July 2010, Kuching, Sarawak, Malaysia. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1877042812010725>
- Piper, A. M., Campbell, R., & Hollan, J. D. (2010). Exploring the accessibility and appeal of surface computing for older adult health care support. Conference Paper. ACM. doi:10.1145/1753326.1753461
- Piper, A. M. & Hollan, J. D. (2013). Supporting medical communication for older patients with a shared touch-screen computer. *International Journal of Medical Informatics*, 82(11), e242–e250. 1386-5056. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1386505611000712>
- Plaza, I., Martín, L., Martín, S., & Medrano, C. (2011). Mobile applications in an aging society: status and trends. *Mobile Applications: Status and Trends*, 84(11), 1977–1988. 0164-1212. Retrieved from <http://www.sciencedirect.com/science/article/pii/S016412121100135X>
- Politis, A. M., Vozzella, S., Mayer, L. S., Onyike, C. U., Baker, A. S., & Lyketsos, C. G. (2004). A randomized, controlled, clinical trial of activity therapy for apathy in patients with dementia residing in long-term care. *International Journal of Geriatric Psychiatry*, 19(11), 1087–1094. doi:10.1002/gps.1215
- Potocnik, F. C. V. (2013). Ethical and medico-legal aspects of dementia. *CME: Continuing Medical Education*, 31(10), 367–370.
- Preece, J., Rogers, Y., Sharp, H., Benyon, D., Holland, S., & Carey, T. (1994). *Human-computer interaction*. Essex, UK, UK: Addison-Wesley Longman Ltd.
- Prince, M., Knapp, M., Guerchet, M., McCrone, P., Prina, M., Comas-Herrera, A., . . . Salimkumar, D. (2014). *Dementia uk: update*. King's College London and the London School of Economics.
- Pringle, A. & Somerville, S. (2013). Computer-assisted reminiscence therapy: developing practice. *Mental Health Practice*, 17(4), 34–37. Retrieved from <http://dx.doi.org/10.7748/mhp2013.12.17.4.34.e830>
- Pulli, P., Hyry, J., Pouke, M., & Yamamoto, G. (2012). User interaction in smart ambient environment targeted for senior citizen. *Medical & Biological Engineering & Computing*, 50(11), 1119–1126. Med Biol Eng Comput 0140-0118. Retrieved from <http://dx.doi.org/10.1007/s11517-012-0906-8>
- Qian, W. & WenDao, W. (2012). Interface design of handheld mobile devices for the older users. In *3rd international conference on e-education, e-business, e-management and e-learning (ipedr)*.
- Ramón-Jerónimo, M. A., Peral-Peral, B., & Arenas-Gaitán, J. (2013). Elderly persons and internet use. *Social Science Computer Review*, 31(4), 389–403. 10.1177/0894439312473421. Retrieved from <http://ssc.sagepub.com/content/31/4/389.abstract>

- Randers, I. & Mattiasson, A.-C. (2004). Autonomy and integrity: upholding older adult patients' dignity. *Journal of Advanced Nursing*, 45(1), 63–71. doi:10.1046/j.1365-2648.2003.02861.x
- Reeder, B., Zaslavsky, O., Wilamowska, K. M., Demir, G., & Thompson, H. J. (2011). Modeling the oldest old: personas to design technology-based solutions for older adults. *AMIA Annual Symposium Proceedings, 2011*, 1166–75.
- Renaud, K. & van Biljon, J. (2008). Predicting technology acceptance and adoption by the elderly: a qualitative study. In *2008 annual research conference of the south african institute of computer scientists and information technologists on it research in developing countries* (pp. 210–219). Proceedings of the 2008 annual research conference of the South African Institute of Computer Scientists and Information Technologists on IT research in developing countries: riding the wave of technology. 1456684: ACM. doi:10.1145/1456659.1456684
- Rosenberg, L., Kottorp, A., & Nygård, L. (2012). Readiness for technology use with people with dementia: the perspectives of significant others. *Journal of Applied Gerontology*, 31(4), 510–530. 10.1177/0733464810396873. Retrieved from <http://jag.sagepub.com/content/31/4/510.abstract>
- Rosenberg, L., Kottorp, A., Winblad, B., & Nygård, L. (2009). Perceived difficulty in everyday technology use among older adults with or without cognitive deficits. *Scandinavian Journal of Occupational Therapy*, 16(4), 216–226. doi: 10.3109/11038120802684299 1103-8128. Retrieved from <http://informahealthcare.com/doi/abs/10.3109/11038120802684299>
- Rosenthal, R. L. (2008). Older computer-literate women: their motivations, obstacles, and paths to success. *Educational Gerontology*, 34(7), 610–626. doi: 10.1080/03601270801949427 0360-1277. Retrieved from <http://dx.doi.org/10.1080/03601270801949427>
- Roupa, Z., Nikas, M., Gerasimou, E., Zafeiri, V., Giasyrani, L., Kazitori, E., & Sotiropoulou, P. (2010). The use of technology by the elderly. *Health Science Journal*, 4(2), 118–126.
- Royal College of Nursing. (n.d.). The rcn's definition of dignity. Retrieved from [https://www.rcn.org.uk/\\_data/assets/pdf\\_file/0003/191730/003298.pdf](https://www.rcn.org.uk/_data/assets/pdf_file/0003/191730/003298.pdf)
- Ryu, M.-H., Kim, S., & Lee, E. (2009). Understanding the factors affecting online elderly user's participation in video ucc services. *Computers in Human Behavior*, 25(3), 619–632. 0747-5632. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0747563208001696>
- Santa-Rosa, J. G. & Fernandes, H. (2012). Application and analysis of the affinities diagram on the examination of usability problems among older adults. *Work: A Journal of Prevention, Assessment and Rehabilitation*, 41(S1), 328–332. Retrieved from <http://dx.doi.org/10.3233/WOR-2012-0177-328>
- Sarantakos, S. (2005). *Social research*. Palgrave Macmillan.
- Sayago, S., Guijarro, J.-M., & Blat, J. (2010). Selective attention in web forms: an exploratory case study with older people. *Behaviour & Information Technology*, 31(2), 171–184. doi: 10.1080/01449291003767920 0144-929X. Retrieved from <http://dx.doi.org/10.1080/01449291003767920>

- Schneider, N., Schreiber, S., Wilkes, J., Grandt, M., & Schlick, C. M. (2008). Foundations of an age-differentiated adaptation of the human-computer interface. *Behaviour & Information Technology*, 27(4), 319–324. doi: 10.1080/01449290701760591 0144-929X. Retrieved from <http://dx.doi.org/10.1080/01449290701760591>
- Seebauer, L., Arthen, T., Austermann, M., Falck, J., Koch, L., Moulds, M. L., & Jacob, G. A. (2016). Mood repair in healthy individuals: both processing mode and imagery content matter. *Journal of Behavior Therapy and Experimental Psychiatry*, 50, 289–294. doi:<http://dx.doi.org/10.1016/j.jbtep.2015.10.005>
- Sellen, A. J. & Whittaker, S. (2010, May). Beyond total capture: a constructive critique of lifelogging. *Commun. ACM*, 53(5), 70–77. doi:10.1145/1735223.1735243
- Shah, P. B. (2011). Intention-to-treat and per-protocol analysis. *Canadian Medical Association Journal*, 183(6), 696. doi:10.1503/cmaj.111-2033. eprint: <http://www.cmaj.ca/content/183/6/696.1.full.pdf+html>
- Shahid, S., Mubin, O., & Al Mahmud, A. (2009). Race: towards exploring the design dimensions of a route assisting and communicating system for elderly. In C. Stephanidis (Ed.), *Universal access in human-computer interaction. addressing diversity* (Vol. 5614, pp. 288–296). Lecture Notes in Computer Science. 978-3-642-02706-2. Berlin: Springer Berlin Heidelberg. Retrieved from [http://dx.doi.org/10.1007/978-3-642-02707-9\\_33](http://dx.doi.org/10.1007/978-3-642-02707-9_33)
- Sharif, F., Mansouri, A., Jahanbin, I., & Zare, N. (2010). Effect of group reminiscence therapy on depression in older adults attending a day centre in shiraz, southern islamic republic of iran. *East Mediterranean Health Journal*, 16(7), 765–770.
- Sharit, J., Hernandez, M. A., Czaja, S. J., & Pirolli, P. (2008). Investigating the roles of knowledge and cognitive abilities in older adult information seeking on the web. *ACM Transactions on Computer-Human Interaction*, 15(1), 1–25. doi:10.1145/1352782.1352785
- Shashidhara, S. (2010). A life course perspective: the aging population and the usage of technology to maintain independence. *Indian Journal of Gerontology*, 24(3), 347–356.
- Shiota, M. N., Neufeld, S. L., Danvers, A. F., Osborne, E. A., Sng, O., & Yee, C. I. (2014). Positive emotion differentiation: a functional approach. *Social and Personality Psychology Compass*, 8(3), 104–117. doi:10.1111/spc3.12092
- Shuster, E. (1997). Fifty years later: the significance of the nuremberg code. *New England Journal of Medicine*, 337(20), 1436–1440. PMID: 9358142. doi:10.1056/NEJM199711133372006. eprint: <http://dx.doi.org/10.1056/NEJM199711133372006>
- Siek, K. A., Ross, S. E., Khan, D. U., Haverhals, L. M., Cali, S. R., & Meyers, J. (2010). Colorado care tablet: the design of an interoperable personal health application to help older adults with multi-morbidity manage their medications. *Project HealthDesign*, 43(5, Supplement), S22–S26. 1532-0464. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1532046410000651>

- Slaughter, S., Cole, D., Jennings, E., & Reimer, M. A. (2007). Consent and assent to participate in research from people with dementia. *Nursing Ethics*, 14(1), 27–40. doi:10.1177/0969733007071355. eprint: <http://nej.sagepub.com/content/14/1/27.full.pdf+html>
- Slegers, K., van Boxtel, M. P., & Jolles, J. (2012). Computer use in older adults: determinants and the relationship with cognitive change over a 6 year episode. *Computers in Human Behavior*, 28(1), 1–10. doi:<http://dx.doi.org/10.1016/j.chb.2011.08.003>
- Song-Lin, H., Chih-Ming, L., Chiu-Yen, Y., & Chen, J.-J. J. (2009). Application of reminiscence treatment on older people with dementia: a case study in pingtung, taiwan. *Journal of Nursing Research (Taiwan Nurses Association)*, 17(2), 112–119. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=43171214&site=ehost-live>
- Stamato, C. & de Moraes, A. (2012). Mobile phones and elderly people: a noisy communication. *Work: A Journal of Prevention, Assessment and Rehabilitation*, 41(S1), 320–327. Retrieved from <http://dx.doi.org/10.3233/WOR-2012-1003-320>
- Steinberg, M., Tschanz, J. T., Corcoran, C., Steffens, D. C., Norton, M. C., Lyketsos, C. G., & Breitner, J. C. (2004). The persistence of neuropsychiatric symptoms in dementia: the cache county study. *International Journal of Geriatric Psychiatry*, 19(1), 19–26. doi:10.1002/gps.1025
- Su, T.-W., Wu, L.-L., & Lin, C.-P. (2012). The prevalence of dementia and depression in taiwanese institutionalized leprosy patients, and the effectiveness evaluation of reminiscence therapy: a longitudinal, single-blind, randomized control study. *International Journal of Geriatric Psychiatry*, 27(2), 187–196. doi:10.1002/gps.2707
- Subramaniam, P., Woods, B., & Whitaker, C. (2014). Life review and life story books for people with mild to moderate dementia: a randomised controlled trial. *Aging & Mental Health*, 18(3), 363–375. PMID: 24063317. doi:10.1080/13607863.2013.837144. eprint: <http://dx.doi.org/10.1080/13607863.2013.837144>
- Tadaka, E. & Kanagawa, K. (2004). A randomized controlled trial of a group care program for community-dwelling elderly people with dementia. *Japan Journal of Nursing Science*, 1(1), 19–25. doi:10.1111/j.1742-7924.2004.00006.x
- Tadaka, E. & Kanagawa, K. (2007). Effects of reminiscence group in elderly people with alzheimer disease and vascular dementia in a community setting. *Geriatrics & Gerontology International*, 7(2), 167–173. doi:10.1111/j.1447-0594.2007.00381.x
- Tanaka, K., Yamada, Y., Kobayashi, Y., Sonohara, K., Machida, A., Nakai, R., . . . Toba, K. (2007). Improved cognitive function, mood and brain blood flow in single photon emission computed tomography following individual reminiscence therapy in an elderly patient with alzheimer's disease. *Geriatrics & Gerontology International*, 7(3), 305–309. doi:10.1111/j.1447-0594.2007.00418.x
- Taveira, A. D. & Choi, S. D. (2009). Review study of computer input devices and older users. *International Journal of Human-Computer Interaction*, 25(5), 455–474. doi: 10.1080/10447310902865040 1044-7318. Retrieved from <http://dx.doi.org/10.1080/10447310902865040>

- Taylor, M. J., Stables, R., Matata, B., Lisboa, P. J. G., Laws, A., & Almond, P. (2014). Website design: technical, social and medical issues for self-reporting by elderly patients. *Health Informatics Journal*, 20(2), 136–150. 10.1177/1460458213488382. Retrieved from <http://jhi.sagepub.com/content/20/2/136.abstractN2>
- Tenneti, R., Johnson, D., Goldenberg, L., Parker, R. A., & Huppert, F. A. (2012). Towards a capabilities database to inform inclusive design: experimental investigation of effective survey-based predictors of human-product interaction. *Applied Ergonomics*, 43(4), 713–726. 0003-6870. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0003687011001700>
- Testad, I., Corbett, A., Aarsland, D., Lexow, K. O., Fossey, J., Woods, B., & Ballard, C. (2014, July). The value of personalized psychosocial interventions to address behavioral and psychological symptoms in people with dementia living in care home settings: a systematic review. *International Psychogeriatrics*, 26, 1083–1098. doi:10.1017/S1041610214000131
- The British Psychological Society. (2014). Code of human research ethics. Retrieved from [http://www.bps.org.uk/sites/default/files/documents/code\\_of\\_human\\_research\\_ethics.pdf](http://www.bps.org.uk/sites/default/files/documents/code_of_human_research_ethics.pdf)
- Thorgrimsen, L., Schweitzer, P., & Orrell, M. (2002). Evaluating reminiscence for people with dementia: a pilot study. *The Arts in Psychotherapy*, 29(2), 93–97. doi:[http://dx.doi.org/10.1016/S0197-4556\(01\)00135-6](http://dx.doi.org/10.1016/S0197-4556(01)00135-6)
- Tolson, D. & Schofield, I. (2012). Football reminiscence for men with dementia: lessons from a realistic evaluation. *Nursing Inquiry*, 19(1), 63–70. doi:10.1111/j.1440-1800.2011.00581.x
- Trevitt, C. & MacKinlay, E. (2004). "just because i can't remember" religiousness in older people with dementia. *Journal of Religious Gerontology*, 16(3-4), 109–121. doi:10.1300/J078v16n03\\_08. eprint: [http://dx.doi.org/10.1300/J078v16n03\\_08](http://dx.doi.org/10.1300/J078v16n03_08)
- Trevitt, C. & MacKinlay, E. (2006). I am just an ordinary person: spiritual reminiscence in older people with memory loss. *Journal of Religion, Spirituality & Aging*, 18(2-3), 79–91. doi:10.1300/J496v18n02\\_07. eprint: [http://dx.doi.org/10.1300/J496v18n02\\_07](http://dx.doi.org/10.1300/J496v18n02_07)
- Tsai, T.-H., Chang, H.-T., Chang, Y.-M., & Huang, G.-S. (2012). Sharetouch: a system to enrich social network experiences for the elderly. *Journal of Systems and Software*, 85(6), 1363–1369. Special Issue: Agile Development. doi:<http://dx.doi.org/10.1016/j.jss.2012.01.023>
- Tseng, K. C., Hsu, C.-L., & Chuang, Y.-H. (2012). Acceptance of information technology and the internet by people aged over fifty in taiwan. *Social Behavior and Personality: An International Journal*, 40(4), 613–622. doi:10.2224/sbp.2012.40.4.613. Retrieved from <http://dx.doi.org/10.2224/sbp.2012.40.4.613>
- UsabilityNet. (2006). What is usability? Retrieved from [http://www.usabilitynet.org/management/b\\_what.htm](http://www.usabilitynet.org/management/b_what.htm)
- Uzer, T. & Gulgoz, S. (2015). Socioemotional selectivity in older adults: evidence from the subjective experience of angry memories. *Memory*, 23(6), 888–900. PMID: 25029295. doi:10.1080/09658211.2014.936877. eprint: <http://dx.doi.org/10.1080/09658211.2014.936877>



- van Diepen, E., Baillon, S. F., Redman, J., Rooke, N., Spencer, D. A., & Prettyman, R. (2002). A pilot study of the physiological and behavioural effects of snoezelen in dementia. *The British Journal of Occupational Therapy*, 65(2), 61–66. doi:10.1177/030802260206500203. eprint: <http://bjo.sagepub.com/content/65/2/61.full.pdf+html>
- van Veldhoven, E., Vastenburg, M., & Keyson, D. (2008). Designing an interactive messaging and reminder display for elderly. In E. Aarts, J. Crowley, B. de Ruyter, H. Gerhäuser, A. Pflaum, J. Schmidt, & R. Wichert (Eds.), *Ambient intelligence* (Vol. 5355, pp. 126–140). Lecture Notes in Computer Science. 978-3-540-89616-6. Berlin: Springer Berlin Heidelberg. Retrieved from [http://dx.doi.org/10.1007/978-3-540-89617-3\\_9](http://dx.doi.org/10.1007/978-3-540-89617-3_9)
- Vastenburg, M., Visser, T., Vermaas, M., & Keyson, D. (2008). Designing acceptable assisted living services for elderly users. In E. Aarts, J. Crowley, B. de Ruyter, H. Gerhäuser, A. Pflaum, J. Schmidt, & R. Wichert (Eds.), *Ambient intelligence* (Vol. 5355, pp. 1–12). Lecture Notes in Computer Science. 978-3-540-89616-6. Berlin: Springer Berlin Heidelberg. Retrieved from [http://dx.doi.org/10.1007/978-3-540-89617-3\\_1](http://dx.doi.org/10.1007/978-3-540-89617-3_1)
- Vetter, S., Bützler, J., Jochems, N., & Schlick, C. M. (2012). Consolidated findings from 6 years research on the age-differentiated design of human-computer interaction. *Work: A Journal of Prevention, Assessment and Rehabilitation*, 41(S1), 5129–5136. Retrieved from <http://dx.doi.org/10.3233/WOR-2012-0082-5129>
- Wagner, N., Hassanein, K., & Head, M. (2010). Computer use by older adults: a multi-disciplinary review. *Computers in Human Behavior*, 26(5), 870–882. 0747-5632. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0747563210000695>
- Wallace, S. E., Graham, C., & Saraceno, A. (2013). Older adults' use of technology. *Perspectives on Gerontology - Special Interests Group 15*, 18(2), 50–59. 10.1044/gero18.2.50 1940-7785 doi: 10.1044/gero18.2.50. Retrieved from <http://dx.doi.org/10.1044/gero18.2.50>
- Wandke, H., Michael, S., & Sonksen, M. (2012). Myths about older people's use of information and communication technology. *Gerontology*, 58, 564–570.
- Wang, J.-J. (2005). The effects of reminiscence on depressive symptoms and mood status of older institutionalized adults in taiwan. *International Journal of Geriatric Psychiatry*, 20(1), 57–62. doi:10.1002/gps.1248
- Wang, J.-J. (2007). Group reminiscence therapy for cognitive and affective function of demented elderly in taiwan. *International Journal of Geriatric Psychiatry*, 22(12), 1235–1240. doi:10.1002/gps.1821
- Wang, J.-J., Yen, M., & OuYang, W.-C. (2009). Group reminiscence intervention in taiwanese elders with dementia. *Archives of Gerontology and Geriatrics*, 49(2), 227–232. doi:http://dx.doi.org/10.1016/j.archger.2008.08.007
- Wang, L., Rau, P.-L. P., & Salvendy, G. (2011). Older adults' acceptance of information technology. *Educational Gerontology*, 37(12), 1081–1099. doi: 10.1080/03601277.2010.500588 0360-1277. Retrieved from <http://dx.doi.org/10.1080/03601277.2010.500588>

- Wang, L., Sato, H., Rau, P.-L. P., Fujimura, K., Gao, Q., & Asano, Y. (2008). Chinese text spacing on mobile phones for senior citizens. *Educational Gerontology*, 35(1), 77–90. doi: 10.1080/03601270802491122 0360-1277. Retrieved from <http://dx.doi.org/10.1080/03601270802491122>
- Wang, Q. (2008). The effects of interface design about mobile phones on older adults' usage. In *4th international conference on wireless communications, networking and mobile computing, 2008 (wicom '08)* (pp. 1–4). 12-14 Oct. 2008.
- Waniek, J. (2008). Age related changes in cognitive abilities and technology. *Gerontechnology*, 7(4), 360. Retrieved from <http://gerontechnology.info/index.php/journal/article/view/gt.2008.07.04.015.00>
- Watt, L. M. & Wong, P. T. P. (1991a). A taxonomy of reminiscence and therapeutic implications. *Journal of Gerontological Social Work*, 16(1-2), 37–57. doi:10.1300/J083v16n01\_04. eprint: [http://dx.doi.org/10.1300/J083v16n01\\_04](http://dx.doi.org/10.1300/J083v16n01_04)
- Watt, L. M. & Wong, P. T. P. (1991b). A taxonomy of reminiscence and therapeutic implications. *Journal of Gerontological Social Work*, 16(1-2), 37–57. doi:10.1300/J083v16n01\_04. eprint: [http://dx.doi.org/10.1300/J083v16n01\\_04](http://dx.doi.org/10.1300/J083v16n01_04)
- Watt, L. & Cappeliez, P. (2000). Integrative and instrumental reminiscence therapies for depression in older adults: intervention strategies and treatment effectiveness. *Aging & Mental Health*, 4(2), 166–177. doi:10.1080/13607860050008691. eprint: <http://dx.doi.org/10.1080/13607860050008691>
- Webster, J. D. (1993a). Construction and validation of the reminiscence functions scale. *Journal of Gerontology*, 48(5), P256–P262. doi:10.1093/geronj/48.5.P256. eprint: <http://geronj.oxfordjournals.org/content/48/5/P256.full.pdf+html>
- Webster, J. D. (1993b). Construction and validation of the reminiscence functions scale. *Journal of Gerontology*, 48(5), P256–P262. doi:10.1093/geronj/48.5.P256. eprint: <http://geronj.oxfordjournals.org/content/48/5/P256.full.pdf+html>
- Webster, J. D. (2003). The reminiscence circumplex and autobiographical memory functions. *Memory*, 11(2), 203–215. PMID: 12820832. doi:10.1080/741938202. eprint: <http://dx.doi.org/10.1080/741938202>
- Westerhof, G. J. & Bohlmeijer, E. T. (2014). Celebrating fifty years of research and applications in reminiscence and life review: state of the art and new directions. *Journal of Aging Studies*, 29, 107–114. doi:<http://dx.doi.org/10.1016/j.jaging.2014.02.003>
- Westerhof, G. J., Bohlmeijer, E., & Webster, J. D. (2010, May). Reminiscence and mental health: a review of recent progress in theory, research and interventions. *Ageing and Society*, 30, 697–721. doi:10.1017/S0144686X09990328
- Whittaker, S., Kalnikaita, V., Petrelli, D., Sellen, A., Villar, N., Bergman, O., ... Brockmeier, J. (2012). Socio-technical lifelogging: deriving design principles for a future proof digital past. *Human Computer Interaction*, 27(1-2), 37–62. doi:10.1080/07370024.2012.656071

- Wild, K. V., Mattek, N. C., Maxwell, S. A., Dodge, H. H., Jimison, H. B., & Kaye, J. A. (2012). Computer-related self-efficacy and anxiety in older adults with and without mild cognitive impairment. *Alzheimer's & Dementia*, 8(6), 544–552. 1552-5260. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1552526012000234>
- Wilkowska, W. & Ziefle, M. (2009). Which factors form older adults' acceptance of mobile information and communication technologies? In A. Holzinger & K. Miesenberger (Eds.), *Hci and usability for e-inclusion* (Vol. 5889, pp. 81–101). Lecture Notes in Computer Science. 978-3-642-10307-0. Berlin: Springer Berlin Heidelberg. Retrieved from [http://dx.doi.org/10.1007/978-3-642-10308-7\\_6](http://dx.doi.org/10.1007/978-3-642-10308-7_6)
- Williams, D., Ul Alam, M. A., Ahamed, S. I., & Chu, W. (2013). Considerations in designing human-computer interfaces for elderly people. In *2013 13th international conference on quality software (qsic)* (pp. 372–377). 29-30 July 2013.
- Williams, V., Boyle, G., Jepson, M., Swift, P., Williamson, T., & Heslop, P. (2014). Best interests decisions: professional practices in health and social care. *Health & Social Care in the Community*, 22(1), 78–86. doi:10.1111/hsc.12066
- Wong, P. T. & Watt, L. M. (1991). What types of reminiscence are associated with successful aging?. *Psychology and Aging*, 6(2), 272–279. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=pdh&AN=1991-30176-001&site=ehost-live>
- Woods, B., Spector, A., Jones, C., Orrell, M., & Davies, S. (2005). Reminiscence therapy for dementia. *Cochrane Database Syst Rev*, (2), CD001120. doi:10.1002/14651858.CD001120.pub2
- World Health Organisation. (2012). Dementia: a public health priority. Retrieved from [http://apps.who.int/iris/bitstream/10665/75263/1/9789241564458\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/75263/1/9789241564458_eng.pdf)
- Wu, L.-F. & Koo, M. (2015). Randomized controlled trial of a six-week spiritual reminiscence intervention on hope, life satisfaction, and spiritual well-being in elderly with mild and moderate dementia. *International Journal of Geriatric Psychiatry*, n/a–n/a. doi:10.1002/gps.4300
- Xue, L., Yen, C. C., Chang, L., Chan, H. C., Tai, B. C., Tan, S. B., ... Choolani, M. (2012). An exploratory study of ageing women's perception on access to health informatics via a mobile phone-based intervention. *International Journal of Medical Informatics*, 81(9), 637–648. 1386-5056. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1386505612000755>
- Young, R., Willis, E., Cameron, G., & Geana, M. (2014). "willing but unwilling": attitudinal barriers to adoption of home-based health information technology among older adults. *Health Informatics Journal*, 20(2), 127–135. 10.1177/1460458213486906. Retrieved from <http://jhi.sagepub.com/content/20/2/127.abstract>
- Zhang, B., Rau, P.-L. P., & Salvendy, G. (2009). Design and evaluation of smart home user interface: effects of age, tasks and intelligence level. *Behaviour & Information Technology*, 28(3), 239–249. doi: 10.1080/01449290701573978 0144-929X. Retrieved from <http://dx.doi.org/10.1080/01449290701573978>

- Zhao, Z., Rau, P.-L. P., Zhang, T., & Salvendy, G. (2009). Visual search-based design and evaluation of screen magnifiers for older and visually impaired users. *International Journal of Human-Computer Studies*, 67(8), 663–675. 1071-5819. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1071581909000548>
- Zhou, J., Rau, P.-L. P., & Salvendy, G. (2012). Use and design of handheld computers for older adults: a review and appraisal. *International Journal of Human-Computer Interaction*, 28(12), 799–826. doi: 10.1080/10447318.2012.668129 1044-7318. Retrieved from <http://dx.doi.org/10.1080/10447318.2012.668129>
- Zhou, S., Chen, Z., Liu, X., & Tang, H. (n.d.). An “elder mode” of new generation phone using augment reality. In *2011 3rd international conference on environmental science and information application technology esiat 2011* (Vol. 10, Part B, pp. 936–942). 1878-0296. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1878029611003458>
- Zhou, W., He, G., Gao, J., Yuan, Q., Feng, H., & Zhang, C. K. (2012). The effects of group reminiscence therapy on depression, self-esteem, and affect balance of chinese community-dwelling elderly. *Archives of Gerontology and Geriatrics*, 54(3), e440–e447. doi:<http://dx.doi.org/10.1016/j.archger.2011.12.003>
- Ziefle, M. (2010). Information presentation in small screen devices: the trade-off between visual density and menu foresight. *Applied Ergonomics*, 41(6), 719–730. 0003-6870. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0003687010000463>

## APPENDIX

### A

## ETHICAL PAPERWORK

The following section includes all the paperwork provided and obtained as part of the process for obtaining an ethical opinion for each study. In addition to the ethical review, study 3 and 4 needed to be approved by the Alzheimer's Society before contact with potential participants could be made. This section includes the paperwork submitted to the Alzheimer's Society, together with the confirmation from Kelly Inwood, Services Support Manager Basingstoke, Winchester and Test Valley.

Table A.1: Summary of Ethical Review Application Numbers

Study	Reference Number
1	449D-201F-3600-550A-0C5F-9403-34A6-A434
2	C6CE-04BB-EA1C-2230-DA00-CB7C-82C4-56A5
3	NHS Reference: 12/SC/0670 SoC Reference: D265-BC41-E71B-5943-BB61-F7A1-274B-32A7
4	6ECD-F182-7EFF-F5C4-F32F-6F54-840E-E4D1

## A.1 Study 1



### Certificate of Fast Track Ethics Review

<b>Project Title:</b>	The Perception of Memories
<b>Student Number:</b>	527922
<b>Application Date:</b>	17/07/2013 12:19:46

You must download your referral certificate, print a copy and keep it as a record of this review.

You should **submit your certificate to your FEC representative for further review.**

The FEC representative for the School of Computing is Carl Adams

It is your responsibility to follow the University Code of Practice on Ethical Standards and any Department/School or professional guidelines in the conduct of your study including relevant guidelines regarding health and safety of researchers including the following:

- University Policy
- Safety on Geological Fieldwork

It is also your responsibility to follow University guidance on Data Protection Policy:

- General guidance for all data protection issues
- University Data Protection Policy

**ProjectTitle:**  
The Perception of Memories

**SchoolOrDepartment:**  
SOC

**PrimaryRole:**  
PostgraduateStudent

**SupervisorName:**  
Dr Alice Good

**HumanParticipants:**  
Yes

**HumanParticipantsWarning**

**Certificate Code:** 449D-201F-3600-550A-0C5F-9403-34A6-A434      Page 1 / 3

**Participant Information Sheets:**

This study involves the use of a questionnaire in both an online and offline format. It begins with an invitation, which includes details of the study together with information about the research project as a whole. In addition, participants have been informed that their data may be used as part of future research.

As the responses from this study will remain anonymous and untraceable, consent is not required. This is in accordance with chapter 11, section 7 of the Mental Capacity Act Code of Practice.

**Participant Confidentiality:**

The questionnaire includes no information which will allow the researcher to identify the participants.

In order to maintain participant anonymity, the online questionnaire will be set to not track the IP addresses of respondents. With regards to the offline questionnaire, the participants will be given stamped addressed envelopes in order to return their completed form.

All completed responses will be held securely, with the paper copies being stored in a locked cabinet until successful completion of the PhD.

**Involves NHS Patients or Staff:**

No

**No Consent or Deception:**

No

**Involves Uninformed or Dependents:**

No

**Drugs, Placebos or Other Substances:**

No

**Blood or Tissue Samples:**

No

**Pain or Mild Discomfort:**

No

**Psychological Stress or Anxiety:**

Yes

**Psychological Stress or Anxiety Warning Prolonged or Repetitive Testing:**

No

**Financial Inducements:**

No

**Physical or Ecological Damage:**

No

**Historical or Cultural Damage:**

No

**Harm to Animal:**

No


**Harmful to Third Parties:**

No

**Supervisor Review**

Supervisor signature:

Date:


  
17/7/13**Review by FEC Representative**

Name of representative:

Comments:

Representative signature:

Date:

  
17/7/13

All OK.



## A.2 Study 2



### Certificate of Ethics Review

<b>Project Title:</b>	Developing Dementia Friendly Interfaces
<b>User ID:</b>	527922
<b>Name:</b>	Claire Ancient
<b>Application Date:</b>	08/01/2015 11:42:53

You must download your certificate, print a copy and keep it as a record of this review.

The chair person of the Technology Faculty Ethics Committee is John Williams.

It is your responsibility to adhere to the University Ethics Policy and any Department/School or professional guidelines in the conduct of your study including relevant guidelines regarding health and safety of researchers and University Health and Safety Policy.

It is also your responsibility to follow University guidance on Data Protection Policy:

- General guidance for all data protection issues
- University Data Protection Policy

You are reminded that as a University of Portsmouth Researcher you are bound by the UKRIO Code of Practice for Research; any breach of this code could lead to action being taken following the University's Procedure for the Investigation of Allegations of Misconduct in Research.

Any changes in the answers to the questions reflecting the design, management or conduct of the research over the course of the project must be notified to the Faculty Ethics Committee. **Any changes that affect the answers given in the questionnaire, not reported to the Faculty Ethics Committee, will invalidate this certificate.**

This ethical review should not be used to infer any comment on the academic merits or methodology of the project. If you have not already done so, you are advised to develop a clear protocol/proposal and ensure that it is independently reviewed by peers or others of appropriate standing. A favourable ethical opinion should not be perceived as permission to proceed with the research; there might be other matters of governance which require further consideration including the agreement of any organisation hosting the research.

#### Governance Checklist

**A1-BriefDescriptionOfProject:** This study uses a systematic literature review to develop guidelines which will aim to make interfaces "dementia-friendly". Through creating interfaces which cater for the symptoms associated with dementia, potentially beneficial technology will become accessible to a rapidly growing demographic.

**A2-Faculty:** Technology

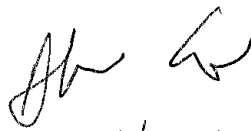
**A5-AlreadyExternallyReviewed:** No

**B1-HumanParticipants:** No

**Certificate Code:** C6CE-04BB-EA1C-2230-DA00-CB7C-82C4-56A5 Page 1

**HumanParticipantsDefinition****B2-HumanParticipantsConfirmation:** Yes**C6-SafetyRisksBeyondAssessment:** No**D2-PhysicalEcologicalDamage:** No**D4-HistoricalOrCulturalDamage:** No**E1-ContentiousOrIllegal:** No**E2-SociallySensitiveIssues:** No**F1-InvolvesAnimals:** No**F2-HarmfulToThirdParties:** No**G1-ConfirmReadEthicsPolicy:** Confirmed**G2-ConfirmReadUKRIOCodeOfPractice:** Confirmed**G3-ConfirmReadConcordatToSupportResearchIntegrity:** Confirmed**G4-ConfirmedCorrectInformation:** Confirmed

13/3/2015



16th March / 2015

## A.3 Study 3

### A.3.1 Participant Information Sheets

#### A.3.1.1 Person Living with Dementia



School of Computing  
University of Portsmouth  
Buckingham Building Lion  
Terrace  
Portsmouth PO1 3HE  
United Kingdom  
T: +44 (0)23 9284 6363 F:  
+44 (0)23 9284 6364

### Participant Information Sheet

#### Mobile Application to Aid Reminiscence in Dementia Patients

You are being invited to take part in a research study.

You may be asked to participate in one of the following activities:

- ☐ Initial Focus Group
- ☐ Design Focus Group
- ☐ Group Testing Session
- ☐ Individual Testing

Before you decide, it is important for you to understand why the research is being done and what it will involve.

Please take time to read the information on the following pages carefully.

**What is the purpose of the study?**

By the Prime Minister's own admission dementia has become a crisis. As there is currently no cure, we need to be thinking about ways in which to use the current advances in technology in order to alleviate some of the symptoms. Reminiscence therapy (RT) may provide a possible solution. RT involves using objects (such as photos) from one's past to encourage the discussion of memories. It can be argued that RT has a significant positive impact on the happiness of people with dementia. It can also improve communication skills and a person's self-awareness.

With the invention of portable touch screen computers; there is the potential to produce a program which can help with the reminiscence process. This study proposes to design a portable touch screen computer program based upon reminiscence theory. It will be designed to act as a storage for 'positive memories' capable of holding a range of objects such as photos and music.

This research will look at the requirements for building such a program, and its effectiveness in aiding reminiscence. Once the program has been developed, further research will be carried out in order to assess whether it influences the happiness of both you and your carer. This research will investigate how easy you think the program is to use.

**Why have I been invited?**

As a person who has dementia, you have been chosen to take part in this study.

If you are taking part in the initial stages of the research, your opinions will be invaluable in driving the design of the program.

If you are taking part in the testing stages of the research, your opinions will be used to evaluate whether the developed program improves feelings of happiness for both you and the person you are caring for.

**Do I have to take part?**

This is a voluntary study and as such it is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep, together with a copy of the attached consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.

**What will it involve?**

- |  |  |
|--|--|
| <input type="checkbox"/> Initial Focus Group   | This focus group will involve a discussion of your current reminiscence activities. It will also look at what you want from a program designed to aid reminiscence therapy.  |
| <input type="checkbox"/> Design Focus Group    | This focus group will involve discusses possible designs for the program. You will have a direct input into how the final product will look and function.  |
| <input type="checkbox"/> Group Testing Session | This will involve a group reminiscence therapy session using the communal memories section of the program. This will involve discussion of memories from various significant eras. You will then be asked your opinion on the session and the effectiveness of the program.  |
| <input type="checkbox"/> Individual Testing    | During the individual testing activity, you will be asked to take the portable touch screen computer (with the program installed) home for use until an agreed date. You will be encouraged to use the app for personal reminiscence, with a discussion after the agreed date on how effective and useful you believe the program to be. |

**What are the possible disadvantages and risks of taking part?**

Distress due to reliving personal memories may be felt during the discussions. Should you feel unhappy at any time with the direction the conversation is taking, please inform the researcher, your carer or the representative of the Alzheimer's Society immediately.

**What are the possible benefits of taking part?**

It has been suggested that RT could improve the happiness of people with dementia and their carers. By taking part in this research, you will be able to help drive the design of a program which could make the reminiscence process easier.

**Will I be recorded, and how will the recorded media be used?**

The researchers will be using audio recording equipment during the sessions. The audio recording of your activities made during this research will only be used for analysis. No other use will be made of them without your written permission, and no one outside the study will be allowed access to the original recordings.

If you are taking part in the testing stages of the research, the reminiscence sessions will not be recorded. However, subsequent discussions about the program will be recorded.

**What will happen to the results of this research study?**

The results of this research will be included within the supporting documentation for a PhD thesis. The results from this research will be submitted for publication within relevant journals and conference proceedings. We will be more than happy to supply you with a printout of any publications upon request.

**Who is organising and funding the research?**

As part of a PhD project, this research is supported by the University of Portsmouth. It is being organised with the agreement of Kelly Inwood (Support Services Manager, Alzheimer's Society) and the Winchester Office of the Alzheimer's Society.

**Who has reviewed the study?**

This study has been reviewed by the NHS Research Ethics Committee South Central - Berkshire (reference number: 12 / SC / 0670).

Thank you for taking the time to read this information sheet.  
Should you have any questions, please do not hesitate to ask us.

**For further information, please contact:**

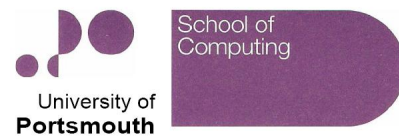
Dr Alice Good - [alice.good@port.ac.uk](mailto:alice.good@port.ac.uk) (023 9284 6664)

Claire Ancient - [claire.ancient@port.ac.uk](mailto:claire.ancient@port.ac.uk) (023 9284 6460)

Alzheimer's Society, Winchester Office - [winchester@alzheimers.org.uk](mailto:winchester@alzheimers.org.uk) (01962 865 585)

University of Portsmouth  
School of Computing  
Buckingham Building  
Lion Terrace  
Portsmouth  
PO1 3HE

Alzheimer's Society - Winchester Office  
The Coach House  
St Waleric Resource Centre  
Park Road  
Winchester  
SO23 7BE

**A.3.1.2 Carer**

School of Computing  
University of Portsmouth  
Buckingham Building Lion  
Terrace  
Portsmouth PO1 3HE  
United Kingdom

T: +44 (0)23 9284 6363 F:  
+44 (0)23 9284 6364

## Participant Information Sheet

### Mobile Application to Aid Reminiscence in Dementia Patients

You are being invited to take part in a research study.

You may be asked to participate in one of the following activities:

- ☐ Initial Focus Group
- ☐ Design Focus Group
- ☐ Group Testing Session
- ☐ Individual Testing

Before you decide, it is important for you to understand why the research is being done and what it will involve.

Please take time to read the information on the following pages carefully.

**What is the purpose of the study?**

By the Prime Minister's own admission dementia has become a crisis. As there is currently no cure, we need to be thinking about ways in which to use the current advances in technology in order to alleviate some of the symptoms. Reminiscence therapy (RT) may provide a possible solution. RT involves using objects (such as photos) from one's past to encourage the discussion of memories. It can be argued that RT has a significant positive impact on the happiness of people with dementia. It can also improve communication skills and a person's self-awareness.

With the invention of portable touch screen computers; there is the potential to produce a program which can help with the reminiscence process. This study proposes to design a portable touch screen computer program based upon reminiscence theory. It will be designed to act as a storage for 'positive memories' capable of holding a range of objects such as photos and music.

This research will look at the requirements for building such a program, and its effectiveness in aiding reminiscence. Once the program has been developed, further research will be carried out in order to assess whether it influences the happiness of both you and the person you care for. This research will investigate how easy you think the program is to use.

**Why have I been invited?**

As a carer of a person who has dementia, you have been chosen to take part in this study.

If you are taking part in the initial stages of the research, your opinions will be invaluable in driving the design of the program.

If you are taking part in the testing stages of the research, your opinions will be used to evaluate whether the developed program improves feelings of happiness for both you and the person you are caring for.

**Do I have to take part?**

This is a voluntary study and as such it is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep, together with a copy of the attached consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.



**What will it involve?**

- |  |  |
|--|--|
| <input type="checkbox"/> Initial Focus Group   | This focus group will involve a discussion of your current reminiscence activities. It will also look at what you want from a program designed to aid reminiscence therapy.  |
| <input type="checkbox"/> Design Focus Group    | This focus group will involve discussing possible designs for the program. You will have a direct input into how the final product will look and function.   |
| <input type="checkbox"/> Group Testing Session | This will involve a group reminiscence therapy session using the communal memories section of the program. This will involve discussion of memories from various significant eras. You will then be asked your opinion on the session and the effectiveness of the program.  |
| <input type="checkbox"/> Individual Testing    | During the individual testing activity, you will be asked to take the portable touch screen computer (with the program installed) home for use until an agreed date. You will be encouraged to use the app for personal reminiscence, with a discussion after the agreed date on how effective and useful you believe the program to be. |

**What are the possible disadvantages and risks of taking part?**

Distress due to reliving personal memories may be felt during the discussions. Should you feel unhappy at any time with the direction the conversation is taking, please inform the researcher or the representative of the Alzheimer's Society immediately.

**What are the possible benefits of taking part?**

It has been suggested that RT could improve the happiness of people with dementia and their carers. By taking part in this research, you will be able to help drive the design of a program which could make the reminiscence process easier.

**Will I be recorded, and how will the recorded media be used?**

The researchers will be using audio recording equipment during the sessions. The audio recording of your activities made during this research will only be used for analysis. No other use will be made of them without your written permission, and no one outside the study will be allowed access to the original recordings.

If you are taking part in the testing stages of the research, the reminiscence sessions will not be recorded. However, subsequent discussions about the program will be recorded.

**What will happen to the results of this research study?**

The results of this research will be included within the supporting documentation for a PhD thesis. The results from this research will be submitted for publication within relevant journals and conference proceedings. We will be more than happy to supply you with a printout of any publications upon request.

**Who is organising and funding the research?**

As part of a PhD project, this research is supported by the University of Portsmouth. It is being organised with the agreement of Kelly Inwood (Support Services Manager, Alzheimer's Society) and the Winchester Office of the Alzheimer's Society.

**Who has reviewed the study?**

This study has been reviewed by the NHS Research Ethics Committee South Central - Berkshire (reference number: 12 / SC / 0670).

Thank you for taking the time to read this information sheet.  
Should you have any questions, please do not hesitate to ask us.

**For further information, please contact:**

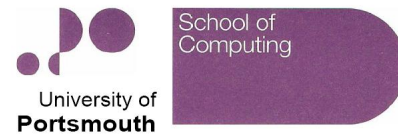
Dr Alice Good - [alice.good@port.ac.uk](mailto:alice.good@port.ac.uk) (023 9284 6664)

Claire Ancient - [claire.ancient@port.ac.uk](mailto:claire.ancient@port.ac.uk) (023 9284 6460)

Alzheimer's Society, Winchester Office - [winchester@alzheimers.org.uk](mailto:winchester@alzheimers.org.uk) (01962 865 585)

University of Portsmouth  
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Lion Terrace  
Portsmouth  
PO1 3HE

Alzheimer's Society - Winchester Office  
The Coach House  
St Waleric Resource Centre  
Park Road  
Winchester  
SO23 7BE

**A.3.1.3 Dementia Support Worker**

School of Computing  
University of Portsmouth  
Buckingham Building Lion  
Terrace  
Portsmouth PO1 3HE  
United Kingdom

T: +44 (0)23 9284 6363 F:  
+44 (0)23 9284 6364

## Participant Information Sheet

### Mobile Application to Aid Reminiscence in Dementia Patients

You are being invited to take part in a research study.

Before you decide, it is important for you to understand why the research is being done and what it will involve.

Please take time to read the information on the following pages carefully.

**What is the purpose of the study?**

By the Prime Minister's own admission dementia has become a crisis. As there is currently no cure, we need to be thinking about ways in which to use the current advances in technology in order to alleviate some of the symptoms. Reminiscence therapy (RT) may provide a possible solution. RT involves using objects (such as photos) from one's past to encourage the discussion of memories. It can be argued that RT has a significant positive impact on the happiness of people with dementia. It can also improve communication skills and a person's self-awareness.

With the invention of portable touch screen computers; there is the potential to produce a program which can help with the reminiscence process. This study proposes to design a portable touch screen computer program based upon reminiscence theory. It will be designed to act as a storage for 'positive memories' capable of holding a range of objects such as photos and music.

This research will look at the requirements for building such a program, and its effectiveness in aiding reminiscence. Once the program has been developed, further research will be carried out in order to assess whether it influences the happiness of people with dementia and their carer.

**Why have I been invited?**

As a support worker, you have extensive experience of the needs that people with dementia and their carers have.

You will be taking part in the initial stages of the research; your opinions will be invaluable in driving the design of the program.

**Do I have to take part?**

This is a voluntary study and as such it is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep, together with a copy of the attached consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.

**What will it involve?**

This focus group will involve a discussion of existing reminiscence activities. It will look at what is required from a portable touch screen computer program designed to help the reminiscence process.

**What are the possible disadvantages and risks of taking part?**

Distress due to reliving personal memories may be felt during the discussions. Should you feel unhappy at any time with the direction the conversation is taking, please inform the researcher immediately.

**What are the possible benefits of taking part?**

It has been suggested that RT could improve the happiness of people with dementia and their carers. By taking part in this research, you will be able to help drive the design of a program which could make the reminiscence process easier.

**Will I be recorded, and how will the recorded media be used?**

The researchers will be using audio recording equipment during the sessions. The audio recording of your activities made during this research will only be used for analysis. No other use will be made of them without your written permission, and no one outside the study will be allowed access to the original recordings.

**What will happen to the results of this research study?**

The results of this research will be included within the supporting documentation for a PhD thesis. The results from this research will be submitted for publication within relevant journals and conference proceedings. We will be more than happy to supply you with a printout of any publications upon request.

**Who is organising and funding the research?**

As part of a PhD project, this research is supported by the University of Portsmouth. It is being organised with the agreement of Kelly Inwood (Support Services Manager, Alzheimer's Society) and the Winchester Office of the Alzheimer's Society.

**Who has reviewed the study?**

This study has been reviewed by the NHS Research Ethics Committee South Central - Berkshire (reference number: 12 / SC / 0670).

Thank you for taking the time to read this information sheet.  
Should you have any questions, please do not hesitate to ask us.

**For further information, please contact:**

Dr Alice Good - [alice.good@port.ac.uk](mailto:alice.good@port.ac.uk) (023 9284 6664)

Claire Ancient - [claire.ancient@port.ac.uk](mailto:claire.ancient@port.ac.uk) (023 9284 6460)

Alzheimer's Society, Winchester Office - [winchester@alzheimers.org.uk](mailto:winchester@alzheimers.org.uk) (01962 865 585)

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Buckingham Building  
Lion Terrace  
Portsmouth  
PO1 3HE

Alzheimer's Society - Winchester Office  
The Coach House  
St Waleric Resource Centre  
Park Road  
Winchester  
SO23 7BE

## A.3.2 Participant Consent Forms

### A.3.2.1 Person Living with Dementia



School of Computing  
University of Portsmouth  
Buckingham Building Lion  
Terrace  
Portsmouth PO1 3HE  
United Kingdom

T: +44 (0)23 9284 6363 F:  
+44 (0)23 9284 6364

Study Activity:  
Participant Identification Number:

### CONSENT FORM

**Title of Project:** Mobile Application to Aid Reminiscence in Dementia Patients  
**Name of Researchers:** Dr. Alice Good, Claire Ancient, Adam Afghan

Please Initial All  
Boxes

- |    |   |                          |
|----|---|--------------------------|
| 1. | I confirm that I have read and understand the information sheet dated January 2013 (version 5) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. | <input type="checkbox"/> |
| 2. | I understand that my participation is voluntary and that I am free to withdraw at any time without giving reason, without my care or legal rights being affected.   | <input type="checkbox"/> |
| 3. | I agree to take part in the above study.  | <input type="checkbox"/> |
| 4. | I agree to the retention and future use of data in the event of me losing the capacity to consent.  | <input type="checkbox"/> |
| 5. | I agree to discussions relating to the study being audio recorded.  | <input type="checkbox"/> |
| 6. | I agree to the use of anonymised quotes in publications   | <input type="checkbox"/> |

\_\_\_\_\_  
Name of Participant

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Person Taking Consent

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Consent Form Issue Date:  
Consent Form Version Number: Version 5 January 2013

Page 1 of 1

## A.3.2.2 Carer



School of Computing  
University of Portsmouth  
Buckingham Building Lion  
Terrace  
Portsmouth PO1 3HE  
United Kingdom

T: +44 (0)23 9284 6363 F:  
+44 (0)23 9284 6364

Study Activity:  
Participant Identification Number:

---

## CONSENT FORM

---

**Title of Project:** Mobile Application to Aid Reminiscence in Dementia Patients  
**Name of Researchers:** Dr. Alice Good, Claire Ancient, Adam Afghan

Please Initial All  
Boxes

1. I confirm that I have read and understand the information sheet dated January 2013 (version 5) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving reason, without my care or legal rights being affected.
3. I agree to take part in the above study.
4. I agree to discussions relating to the study being audio recorded.
5. I agree to the use of anonymised quotes in publications

☐
☐
☐
☐
☐

\_\_\_\_\_  
Name of Participant

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Person Taking Consent

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Consent Form Issue Date:  
Consent Form Version Number: Version 5 January 2013

Page 1 of 1

**A.3.2.3 Dementia Support Worker**

School of Computing  
University of Portsmouth  
Buckingham Building Lion  
Terrace  
Portsmouth PO1 3HE  
United Kingdom

T: +44 (0)23 9284 6363 F:  
+44 (0)23 9284 6364

Study Activity:  
Participant Identification Number:

---

## CONSENT FORM

---

**Title of Project:** Mobile Application to Aid Reminiscence in Dementia Patients  
**Name of Researchers:** Dr. Alice Good, Claire Ancient, Adam Afghan

Please Initial All  
Boxes

1. I confirm that I have read and understand the information sheet dated January 2013 (version 5) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving reason, without my care or legal rights being affected.
3. I agree to take part in the above study.
4. I agree to discussions relating to the study being audio recorded.
5. I agree to the use of anonymised quotes in publications

☐
☐
☐
☐
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\_\_\_\_\_  
Name of Participant

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Person Taking Consent

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Consent Form Issue Date:  
Consent Form Version Number: Version 5 January 2013

Page 1 of 1



### A.3.3 Alzheimer's Society Paperwork

#### A.3.3.1 Initial Support Letter

Alzheimer's Society  
**Basingstoke & District (inc Winchester and Test Valley North)**  
8 Chequers Road  
Basingstoke  
Hampshire RG21 7PU

Tel: 01256 363393  
Email: [mark.green.org.uk](mailto:mark.green.org.uk)  
[www.alzheimers.org.uk](http://www.alzheimers.org.uk)



Dear Claire

This is to conform that I am sponsoring your Master's project of Mobile Application to Aid Reminiscence with Dementia Patients

I have been involved in the review of all the necessary project documentation and was extremely interested in the demo. I look forward to seeing the end result and will try to publicise it across the Alzheimer's Society as much as possible.

Yours sincerely

A handwritten signature in black ink, appearing to be 'Mark Green'.

Mark Green  
Support Services manager  
Mob No. 07738 455501  
11/7/12

Founded in 1979 as the Alzheimer's Disease Society. Royal Patron: HRH Princess Alexandra, The Hon Lady Ogilvy KG GCVO, President Emeritus: Sir Jonathan Miller CBE, Chair: Alastair Balls CB, Vice-Chair: Eileen Winston, Honorary Treasurer: John Grosvenor FCA CPA. Registered office: Devon House, 58 St Katharine's Way, London E1W 1JX. Registered charity no. 296645. A company limited by guarantee and registered in England no. 2115499.

This research was initially designed to feature as part of a Masters project.

Unfortunately due to time constraints, it was decided to take an alternative approach to the project and continue this research as part of a PhD.

Mark Green at the Alzheimer's Society Basingstoke and District Office continues to fully support this project.

### A.3.3.2 Application Form

## Research with service users: Application form

### All applicants please note:

- The principal investigator must be sponsored by a recognised higher education learning institute (e.g. a University)
- The principal investigator must be studying at PhD level OR has already achieved a PhD Or higher Clinical qualification
- The project must have received ethics consent
- The project must be of local interest and show benefit or value to the Society
- The applicant must prove sufficient experience of working with vulnerable adults, knowledge of the intricacies of working with people with dementia and/or their carers and empathy towards the challenges associated with living with dementia
- Please submit the form to [research@alzheimers.org.uk](mailto:research@alzheimers.org.uk)

### Please attach with your application form:

- Proof of DBS clearance for working with vulnerable adults
- Any additional information which will enhance your application.
- ALL attachments and supporting documentation and the final letter of consent.

### Date submitted:

<b>Principal Application</b>		
Title and Full Name	Miss Claire Ancient	
<b>Institution</b>	University of Portsmouth	
Post Held	Research Student	
Department and Address	School of Computing Buckingham Building Lion Terrace Portsmouth PO1 3HE	
Contact Details	Telephone: 023 9284 6460	Email: <a href="mailto:claire.ancient@port.ac.uk">claire.ancient@port.ac.uk</a>
<b>If you are a student please state the degree you will attain on completion of this research project</b>	PhD in Computing	
Please list other applicants and institutes involved in the application	Applicant	Institute
	Dr Alice Good	University of Portsmouth

Research Title	Mobile Application to Aid Reminiscence in Dementia Patients					
Does this research have ethics approval from NRES?	<u>Yes / No</u>  <b>If yes, please include a full scanned copy of the IRAS application including ALL attachments and supporting documentation and the final letter of consent.</b>					
Research Dates	Start Date: 1st December 2012			Finish Date: 31st December 2015		
Participants	<u>Staff</u>	Volunteers	<u>Persons with dementia</u>	<u>Carers</u>	Family Members	None
Please detail the areas where you are aiming to recruit participants (i.e. town/city/region)	Basingstoke and District (including Winchester)					
Is funding allocated to supporting any costs incurred by the Society in the application?	<u>Yes/ No</u>  There are no anticipated costs to the Alzheimer's Society.  All room rental costs will be paid by the researcher and all tablet devices have already been purchased.					
Have you contacted anyone within Alzheimer's Society about the proposal?	<u>Yes/ No</u> If yes, please provide contact details and dates  Mark Green (July 2012), please see attached agreement in writing to support the research. This letter was used throughout the application for the NHS Research Ethical Review.  Kelly Inwood (August 2014) - <a href="mailto:kelly.inwood@alzheimers.org.uk">kelly.inwood@alzheimers.org.uk</a>					
Are there any conflicts of interest? (e.g. do you work or volunteer at the Society?)	I am currently a volunteer for the Society within the Hampshire Locality					

How specifically do you hope that Alzheimer's Society will be involved?	The Society will be acting in both a gatekeeping and supervisory capacity.
When do you expect Alzheimer's Society involvement to start and finish?	Start date: 19th August 2014  Finish date: 30th September 2014
How do you intend to feed back the results to participants?	There will be an additional discussion with the participants once the study has been completed. They will also be given the opportunity to obtain a copy of the report and any published papers.

Why do you consider Alzheimer's Society to be an appropriate partner for your research proposal?	One of the main aims of the Alzheimer's Society is to support people to live well with dementia within the community. The purpose of this PhD project is to provide a technology-supported reminiscence activity to promote well-being at the point of need. As part of this, the application will be developed using user-centred design methodologies aimed at empowering the person living with dementia to drive their own, personalised reminiscence activity.
Please detail your experience of working with people with dementia or other vulnerable groups	<p>I have previous experience of working with people living with dementia. I have been a volunteer for the Alzheimer's Society for over 3 years. I also have personal experience of the challenges associated with the condition as both my Grandfather and Grandmother were diagnosed with differing forms of dementia.</p> <p>Additionally, I previously volunteered at a youth group for children living with Down's Syndrome, which included an outreach excursion and providing support in a safe environment for them to interact with their peers.</p>

### Summary of project

<p>Please include project aim and objectives, a detailed methodology (including recruitment, anticipated number and location of participants) and details of dissemination plans to a maximum of <b>1000 words</b></p>	<p>This study forms part of a PhD which aims to investigate whether a technology-supported intervention based on positive reminiscence has the potential to improve the well-being of people living with dementia and their carers.</p>
<p>Please attach all appropriate documents with your submission</p>	<p>The aim of this study will be to use a participatory design methodology to develop a mobile application which can facilitate an intervention based on positive reminiscence.</p>
<p>Including;</p> <ul style="list-style-type: none"> <li>- consent forms</li> <li>- information forms</li> <li>- questionnaires</li> <li>- interview templates</li> </ul>	<p>The application is designed to be used within the home environment by both the people living with dementia and their carers. By involving the end users in the development of the application, this will ensure that the app is both usable and beneficial.</p> <p>In order to achieve this, the study will have 3 phases:</p> <p>1. Exploratory Research Phase  <i>This phase of the research will involve a focus group attended by people living with dementia, their carers and a dementia support worker. It will aim to investigate the users needs and the basic requirements of the application. It will aid the design and development process.</i></p> <p><i>Number of Participants: 11 (5 people living with dementia, 5 carers and 1 dementia support worker)</i></p> <p>2. Design and Development Phase  <i>This phase of the research will involve high-fidelity prototyping with people living with dementia and their carers. Participants will be given the opportunity to use tablet computers with potential designs for the application installed. Participants will be encouraged to voice their opinions on the designs, together with any improvements.</i></p> <p><i>Number of Participants: 10 (5 people living with dementia and 5 carers)</i></p> <p>3. Testing Phase  <i>In this phase of the research participants will be loaned a tablet computer with the final application installed for the period of 1 week. During this time they will be encouraged to use the app as often as possible. After the week, participants will be invited to discuss their opinions of the system together with the potential benefits they may foresee should they use the reminiscence app over time.</i></p> <p><i>Number of Participants: 20 (10 people living with dementia and 10 carers)</i></p> <p>In accordance with the favourable opinion from the NHS Research Ethics Committee, no participants who lack capacity will be included within this study.</p> <p>This research has minimal risk to participants. The main potential risk is the possibility of evoking painful memories. The participants will be encouraged to only enter memories into the app which are associated with positive emotions. In addition, at no point will the researcher be alone with the person living with dementia or their carer.</p> <p>As this study is part of a PhD program, this research will be published as part of a thesis. The research may also be included in journal publications and/or conference proceedings. In all such cases, the Alzheimer's Society will be acknowledged as providing support to the research. In addition, all participants will be given the opportunity to obtain copies of all publications, free of charge. Should any participant want to continue to use the reminiscence app, the researcher will be able to provide the application at no cost but not the accompanying tablet computer. The tablet computers used within the study cost approximately £70 to purchase.</p>

### A.3.3.3 Application Form



Claire Ancient <claire.ancient@port.ac.uk>

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## Research with Service Users Application Form

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**Claire Ancient** <claire.ancient@port.ac.uk>  
To: Kelly.Inwood@alzheimers.org.uk

26 August 2014 at 11:09

Dear Kelly,

Hope you are well.

Please see attached the completed application form, together with all the required IRAS paperwork. I have not attached proof of DBS clearance as requested, as at no point during the study had I planned to work on a one-to-one basis with any vulnerable adults. However, as part of my volunteering role at the CrISP satellite sessions, I have completed a DBS application form which is being processed.

Please note that the IRAS form states that there will be a group testing session. Due to the evolution of the project, it was decided to remove this intervention from the study. The IRAS form also states that my colleague Adam Afghan would contribute to the study, this is now not the case, as he has graduated from the University of Portsmouth.

After we spoke at the CrISP session on Wednesday 13th August and agreed I could move forward with this study, I booked rooms for both the focus group and prototyping sessions on 2nd and 9th September respectively. Subsequently, I started to recruit participants at the Dementia Cafe on Tuesday 19th August. After receiving your email requesting the completion of the attached form, I immediately stopped recruitment for the study until this application is processed. Should this be delayed postponements of both the focus group and prototyping sessions will be necessary.

I look forward to hearing from you in the near future with regards to this application.

Kind regards,














Claire Ancient  
Researcher

School of Computing  
University of Portsmouth  
Buckingham Building  
Lion Terrace  
Portsmouth  
PO1 3HE

Email: [claire.ancient@port.ac.uk](mailto:claire.ancient@port.ac.uk)  
Tel: 023 9284 6460

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**13 attachments**

-  **Additional Statement to AS Letter.pdf**  
4K
-  **Carer Consent Form.pdf**  
54K
-  **Carer PIS.pdf**  
345K
-  **CV Claire Ancient Version 2.pdf**  
16K
-  **CV Dr Alice Good.docx**  
20K
-  **IRAS Form.pdf**  
431K
-  **Person with Dementia Consent Form.pdf**  
56K
-  **Person with Dementia PIS.pdf**  
345K
-  **Research Protocol Version 3.pdf**  
26K
-  **Support Worker Consent Form.pdf**  
54K
-  **Support Worker PIS.pdf**  
413K
-  **Research with Service Users Application Form.pdf**  
100K
-  **Support Letter from Mark Green.pdf**  
462K



#### A.3.3.4 Confirmation Email



Claire Ancient <claire.ancient@port.ac.uk>

---

### Research

---

**Inwood, Kelly** <Kelly.Inwood@alzheimers.org.uk>  
To: Claire Ancient <claire.ancient@port.ac.uk>

27 November 2014 at 12:10

Hi Claire,

I have Fab news – we are all approved and ready to go. Feel free to book the room and start recruitment!

Speak soon

Kelly

**From:** Claire Ancient [mailto:[claire.ancient@port.ac.uk](mailto:claire.ancient@port.ac.uk)]  
**Sent:** 13 November 2014 20:46  
**To:** Inwood, Kelly  
**Subject:** Research

Dear Kelly,

[Quoted text hidden]

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We have a great selection of gifts, branded merchandise and daily living products for sale in our online shop [alzheimers.org.uk/shop](http://alzheimers.org.uk/shop)

---

Become a Dementia Friend [dementiafriends.org.uk](http://dementiafriends.org.uk)

---

Alzheimer's Society is a charity (registration no. 296645) and a company registered in England and Wales (registration no. 2115499). Registered office is Devon House, 58 St Katharine's Way, London E1W 1LB

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Claire Ancient <claire.ancient@port.ac.uk>

---

## Research

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**Claire Ancient** <claire.ancient@port.ac.uk>

27 November 2014 at 12:53

To: "Inwood, Kelly" <Kelly.Inwood@alzheimers.org.uk>

Bcc: Sheila Ancient <sheila.ancient@alzheimers.org.uk>

Thanks Kelly,

That is marvellous news!

I now have a favourable ethical opinion for the final part of the study. Would that be classed as an extension to this project (and therefore, already approved), or should I put a new set of paperwork through? I am planning on running it in the new year (probably February/March time) and based on the amount of time this application has taken to get through the research department I would like to submit it as soon as possible.

Thanks again,

Claire

[Quoted text hidden]



Claire Ancient <claire.ancient@port.ac.uk>

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## Research

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**Inwood, Kelly** <Kelly.Inwood@alzheimers.org.uk>  
To: Claire Ancient <claire.ancient@port.ac.uk>

27 November 2014 at 13:01

One application will cover the whole project Claire, can you send me details of the final part? I know we discussed it, but just to refresh my memory! I'm happy to approve you completing the entire study so no need for any more applications!

Kelly

**From:** Claire Ancient [mailto:[claire.ancient@port.ac.uk](mailto:claire.ancient@port.ac.uk)]  
**Sent:** 27 November 2014 12:54  
**To:** Inwood, Kelly  
**Subject:** Re: Research

[Quoted text hidden]



Claire Ancient <claire.ancient@port.ac.uk>

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## Research

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**Claire Ancient** <claire.ancient@port.ac.uk>

27 November 2014 at 14:01

To: "Inwood, Kelly" <Kelly.Inwood@alzheimers.org.uk>

Bcc: Sheila Ancient <sheila.ancient@alzheimers.org.uk>

Thanks Kelly,

The final part of the study involves 3 groups: 1 group will be given a tablet to use at home, 1 group will participate in group reminiscence and the final group will receive no intervention. Each intervention will last for 8 weeks and will all run at the same time. The well-being of the participants will be measured at the beginning, halfway through and at the end of the 8 week period. Upon completion, all participants in the groups not using the tablets will be given the opportunity to see and use the app. In addition, all participants will be able to obtain a copy of all the results, and the final application for their personal use. Unfortunately, due to funding restrictions, we are not able to give the tablets to any participants once the study is completed.

I have attached the favourable opinion received from the University of Portsmouth School of Computing Ethics Committee.

If you have any problems or questions let me know.

Kind regards,

Claire

[Quoted text hidden]

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**ethics opinion.pdf**  
522K

## A.3.4 NHS Paperwork

### A.3.4.1 IRAS Form

NHS REC Form

Reference:  
12/SC/0670

IRAS Version 3.4

Welcome to the Integrated Research Application System

IRAS Project Filter

The integrated dataset required for your project will be created from the answers you give to the following questions. The system will generate only those questions and sections which (a) apply to your study type and (b) are required by the bodies reviewing your study. Please ensure you answer all the questions before proceeding with your applications.

**Please enter a short title for this project** (maximum 70 characters)  
Mobile Application to Aid Reminiscence in Dementia Patients

**1. Is your project research?**

☒ Yes ☐ No

**2. Select one category from the list below:**

- ☐ Clinical trial of an investigational medicinal product
- ☐ Clinical investigation or other study of a medical device
- ☐ Combined trial of an investigational medicinal product and an investigational medical device
- ☐ Other clinical trial to study a novel intervention or randomised clinical trial to compare interventions in clinical practice
- ☐ Basic science study involving procedures with human participants
- ☐ Study administering questionnaires/interviews for quantitative analysis, or using mixed quantitative/qualitative methodology
- ☐ Study involving qualitative methods only
- ☐ Study limited to working with human tissue samples (or other human biological samples) and data (specific project only)
- ☐ Study limited to working with data (specific project only)
- ☐ Research tissue bank
- ☐ Research database

**If your work does not fit any of these categories, select the option below:**

☒ Other study

**2a. Will the study involve the use of any medical device without a CE Mark, or a CE marked device which has been modified or will be used outside its intended purposes?**

☐ Yes ☒ No

**2b. Please answer the following question(s):**

- a) Does the study involve the use of any ionising radiation? ☐ Yes ☒ No
- b) Will you be taking new human tissue samples (or other human biological samples)? ☐ Yes ☒ No
- c) Will you be using existing human tissue samples (or other human biological samples)? ☐ Yes ☒ No

**3. In which countries of the UK will the research sites be located?** *(Tick all that apply)*

☒ England

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- ☐ Scotland  
☐ Wales  
☐ Northern Ireland

**3a. In which country of the UK will the lead NHS R&D office be located:**

- ☒ England  
☐ Scotland  
☐ Wales  
☐ Northern Ireland  
☐ This study does not involve the NHS

**4. Which review bodies are you applying to?**

- ☐ NHS/HSC Research and Development offices  
☐ Social Care Research Ethics Committee  
☒ Research Ethics Committee  
☐ National Information Governance Board for Health and Social Care (NIGB)  
☐ Ministry of Justice (MoJ)  
☐ National Offender Management Service (NOMS) (Prisons & Probation)

*For NHS/HSC R&D offices, the CI must create Site-Specific Information Forms for each site, in addition to the study-wide forms, and transfer them to the PIs or local collaborators.*

**5. Will any research sites in this study be NHS organisations?**

- ☐ Yes ☒ No

**6. Do you plan to include any participants who are children?**

- ☐ Yes ☒ No

**7. Do you plan at any stage of the project to undertake intrusive research involving adults lacking capacity to consent for themselves?**

- ☒ Yes ☐ No

*Answer Yes if you plan to recruit living participants aged 16 or over who lack capacity, or to retain them in the study following loss of capacity. Intrusive research means any research with the living requiring consent in law. This includes use of identifiable tissue samples or personal information, except where application is being made to the NIGB Ethics and Confidentiality Committee to set aside the common law duty of confidentiality in England and Wales. Please consult the guidance notes for further information on the legal frameworks for research involving adults lacking capacity in the UK.*

**8. Do you plan to include any participants who are prisoners or young offenders in the custody of HM Prison Service or who are offenders supervised by the probation service in England or Wales?**

- ☐ Yes ☒ No

**9. Is the study or any part of it being undertaken as an educational project?**

- ☒ Yes ☐ No

Please describe briefly the involvement of the student(s):  
 The research will be undertaken by the student, Claire Ancient, under the supervision of Dr Alice Good.

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**9a. Is the project being undertaken in part fulfilment of a PhD or other doctorate?**☒ Yes ☐ No**10. Will this research be financially supported by the United States Department of Health and Human Services or any of its divisions, agencies or programs?**☐ Yes ☒ No**11. Will identifiable patient data be accessed outside the care team without prior consent at any stage of the project (including identification of potential participants)?**☐ Yes ☒ No

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**Integrated Research Application System**  
**Application Form for Other research****Application to NHS/HSC Research Ethics Committee**

The Chief Investigator should complete this form. Guidance on the questions is available wherever you see this symbol displayed. We recommend reading the guidance first. The complete guidance and a glossary are available by selecting [Help](#).

Please define any terms or acronyms that might not be familiar to lay reviewers of the application.

**Short title and version number:** (maximum 70 characters - this will be inserted as header on all forms)  
Mobile Application to Aid Reminiscence in Dementia Patients

*Please complete these details after you have booked the REC application for review.*

**REC Name:**  
NRES Committee South Central - Berkshire

**REC Reference Number:**  
12/SC/0670

**Submission date:**  
09/11/2012

**PART A: Core study information****1. ADMINISTRATIVE DETAILS****A1. Full title of the research:**

Mobile Application to Aid Reminiscence in Dementia Patients

**A2-1. Educational projects**

Name and contact details of student(s):

**Student 1**

	Title	Forename/Initials	Surname
	Miss	Claire	Ancient
Address	University of Portsmouth, School of Computing Buckingham Building, Lion Terrace Portsmouth		
Post Code	PO1 3HE		
E-mail	claire.ancient@myport.ac.uk		
Telephone	02392846460		
Fax			

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Give details of the educational course or degree for which this research is being undertaken:

Name and level of course/ degree:

PhD Computing

Name of educational establishment:

University of Portsmouth

**Student 2**

Title Forename/Initials Surname

Mr Adam Afghan

Address University of Portsmouth, School of Computing  
Buckingham Building, Lion Terrace  
Portsmouth

Post Code PO1 3HE

E-mail mde90157@myport.ac.uk

Telephone 02392848484

Fax

Give details of the educational course or degree for which this research is being undertaken:

Name and level of course/ degree:

BSc Computing

Name of educational establishment:

University of Portsmouth

Name and contact details of academic supervisor(s):

**Academic supervisor 1**

Title Forename/Initials Surname

Dr Alice Good

Address University of Portsmouth, School of Computing  
Buckingham Building, Lion Terrace  
Portsmouth

Post Code PO1 3HE

E-mail alice.good@port.ac.uk

Telephone 02392846664

Fax

Please state which academic supervisor(s) has responsibility for which student(s):

*Please click "Save now" before completing this table. This will ensure that all of the student and academic supervisor details are shown correctly.*

Student(s)	Academic supervisor(s)
<b>Student 1</b> Miss Claire Ancient	<input checked="" type="checkbox"/> Dr Alice Good
<b>Student 2</b> Mr Adam Afghan	<input checked="" type="checkbox"/> Dr Alice Good

A copy of a current CV for the student and the academic supervisor (maximum 2 pages of A4) must be submitted with the application.

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**A2-2. Who will act as Chief Investigator for this study?**

- ☐ Student  
☒ Academic supervisor  
☐ Other

**A3-1. Chief Investigator:**

	Title Forename/Initials Surname
	Dr Alice Good
Post	Lecturer
Qualifications	PhD, MSc, PGCE HE, BSc
Employer	University of Portsmouth
Work Address	School of Computing
	Buckingham Building, Lion Terrace
	Portsmouth
Post Code	PO1 3HE
Work E-mail	alice.good@port.ac.uk
* Personal E-mail	
Work Telephone	02392846664
* Personal Telephone/Mobile	
Fax	

*\* This information is optional. It will not be placed in the public domain or disclosed to any other third party without prior consent.*  
*A copy of a current CV (maximum 2 pages of A4) for the Chief Investigator must be submitted with the application.*

**A4. Who is the contact on behalf of the sponsor for all correspondence relating to applications for this project?**

*This contact will receive copies of all correspondence from REC and R&D reviewers that is sent to the CI.*

	Title Forename/Initials Surname
	Mrs Denise Teasdale
Address	Research and Knowledge Transfer Services
	University House
	Winston Churchill Avenue
Post Code	PO1 2UP
E-mail	denise.teasdale@port.ac.uk
Telephone	
Fax	

**A5-1. Research reference numbers. Please give any relevant references for your study:**

Applicant's/organisation's own reference number, e.g. R & D (if available): Student: 434446

Sponsor's/protocol number:

Protocol Version:

Protocol Date:

Funder's reference number:

Project website:

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**Registry reference number(s):**

*The Department of Health's Research Governance Framework for Health and Social Care and the research governance frameworks for Wales, Scotland and Northern Ireland set out the requirement for registration of trials. Furthermore: Article 19 of the World Medical Association Declaration of Helsinki adopted in 2008 states that "every clinical trial must be registered on a publicly accessible database before recruitment of the first subject"; and the International Committee of Medical Journal Editors (ICMJE) will consider a clinical trial for publication only if it has been registered in an appropriate registry. Please see guidance for more information.*

International Standard Randomised Controlled Trial Number (ISRCTN):

ClinicalTrials.gov Identifier (NCT number):

**Additional reference number(s):**

Ref.Number	Description	Reference Number
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**A5-2. Is this application linked to a previous study or another current application?**

☐ Yes ☒ No

*Please give brief details and reference numbers.*

**2. OVERVIEW OF THE RESEARCH**

*To provide all the information required by review bodies and research information systems, we ask a number of specific questions. This section invites you to give an overview using language comprehensible to lay reviewers and members of the public. Please read the guidance notes for advice on this section.*

**A6-1. Summary of the study.** *Please provide a brief summary of the research (maximum 300 words) using language easily understood by lay reviewers and members of the public. Where the research is reviewed by a REC within the UK Health Departments Research Ethics Service, this summary will be published on the website of the National Research Ethics Service following the ethical review.*

Reminiscence Therapy has been shown to be beneficial for people with dementia. However, it can be resource intensive and obviously requires physical attendance of people with dementia. The aim of this research is to develop and evaluate a mobile application (app) to see whether it might be used to aid reminiscence for people with dementia thus performing a similar function to reminiscence therapy.

This study proposes to design an application, based upon reminiscence therapy, which can act as storage for personal and communal 'positive memories' in a range of media types. This will include pictures and audio.

The target for this application is people suffering from dementia or mild cognitive impairment (MCI) and their carers.

This research will look at the requirements for building such an app on the Android operating system, and how effective it actually is in aiding the reminiscence process. The initial stages of the research are designed to obtain key requirements of the app together with the needs of the interface. This knowledge gathering will enable the effective design of the app to enable people with dementia to use it with ease. Once the app has been produced, there will be further research to ensure that it is useful to dementia patients.

**A6-2. Summary of main issues.** *Please summarise the main ethical, legal, or management issues arising from your study and say how you have addressed them.*

*Not all studies raise significant issues. Some studies may have straightforward ethical or other issues that can be identified and managed routinely. Others may present significant issues requiring further consideration by a REC, R&D office or other review body (as appropriate to the issue). Studies that present a minimal risk to participants may raise complex organisational or legal issues. You should try to consider all the types of issues that the different reviewers may need to consider.*

The positive ethical case for undertaking this research is that it has the potential to provide the benefits of reminiscence therapy to people who might otherwise be deprived as a result of limited resources or their own limited

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mobility.

By its very nature, this research will recruit people with dementia who may be mentally incapacitated but with a potential to regain some capacity through their participation. It will therefore be necessary to involve a consultee in the case of most potential participants. It is possible that some participants might have fluctuating capacity and could have sufficient capacity to consent however, it is very likely that at some stage during the research they will lack capacity. Given this position, it might be argued that this research readily meets the demands of the MCA in that it might benefit incapacitated adult participants and/or other people suffering similar incapacitating conditions.

The research has been designed to directly involve people with dementia in producing the app (obviously the personal element) and subsequently evaluating it. It is therefore a form of action research aiming to positively respect participants and value their input.

This research project is being carried out as part of a PhD programme at the University of Portsmouth. However, the student will be closely supervised and furthermore she has personal experience of working with people with dementia. Most significantly, all of the field research will be under the direction of the Alzheimer's Society.

The participants of this study will be invited through the Alzheimer's Society Winchester Office, which will act as gate keepers. In addition to this, there will be no contact with the participants without an Alzheimer's Society representative being present. The people with dementia and their carers will be under no obligation to take part in the research.

If at any point either the consultee or the person with dementia decides to withdraw, they will be immediately removed from the study. Throughout the research process, the well-being of the participant is top priority. It is unlikely, but if it is decided that the study is having a negative effect on the participant they will be removed immediately. Any relevant information gained before the participant is withdrawn will continue to be used as part of the research; however, it will be made anonymous and unidentifiable.

As part of this research, only people with mild-to-moderate dementia will be included. Once the person with dementia reaches the later stages of the illness, they may not be able to effectively communicate. This will make the research extremely difficult and could result in distress to the participant if they cannot verbalise their opinions. Communication is an important element of the reminiscence process, so the participants included must be able to converse.

The participants must be willing to take part in the research. If this is not the case, they will not be coerced to take part in the study. As the research will be looking at the use of reminiscence therapy with both the carer and the person with dementia, they must both consent to being included in the research.

If the person with dementia does not acknowledge that they have a memory problem, this research may cause distress. This will be avoided by only including people who have accepted at some point that they do have difficulties with their memory. The carers will be consulted when it comes to ensuring that this inclusion / exclusion criteria is met.

The main risk to the participants is the possibility of reliving painful memories. In order to minimise this risk, the carers will be consulted on topics to avoid before any reminiscence therapy is carried out. If the person with dementia starts to become distressed, the subject will be changed and in extreme cases, the participant can be removed from the intervention. By ensuring that the carer and a representative from the Alzheimer's Society are present at all interventions, there will always be someone available to comfort any distressed participants.

By including people with dementia in the design process, the target users will be able to operate the resulting application and take part in reminiscence therapy with ease. It could be used as a mechanism for self-soothing together with improving the well-being of the person with dementia. This may be useful to the wider population of Dementia sufferers as well as the participants of the study.

It is not expected that any personal information (other than names) will be collected as part of this study. However, should personal information be collected, it will only be seen by the researcher. In addition to this, personal information will be kept secure. Any personal information which may be collected will be allocated to an ID number. This ID will only allow the researcher to identify the person it related to. The list of ID numbers and relating names will only be accessible to the researcher and will remain secure. At the point of publication, there will be no identifiable information printed and any quotations used will be anonymised.

If the researcher believes that the safety of the participant is at risk, the Alzheimer's Society representative will be notified and consulted. This person will be under the confidentiality which is set out as part of their employment.

Once the research has been completed, all the participants will have the opportunity to have a copy of the final report. If they decide they would like a copy, it will be made available at the earliest possible opportunity free of charge.

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**3. PURPOSE AND DESIGN OF THE RESEARCH****A7. Select the appropriate methodology description for this research. Please tick all that apply:**

- ☐ Case series/ case note review
- ☐ Case control
- ☐ Cohort observation
- ☐ Controlled trial without randomisation
- ☐ Cross-sectional study
- ☐ Database analysis
- ☐ Epidemiology
- ☐ Feasibility/ pilot study
- ☐ Laboratory study
- ☐ Metanalysis
- ☒ Qualitative research
- ☒ Questionnaire, interview or observation study
- ☐ Randomised controlled trial
- ☐ Other (please specify)

**A10. What is the principal research question/objective? Please put this in language comprehensible to a lay person.**

Can a mobile application, based on the idea of reminiscence therapy be of benefit to people with dementia?

**A11. What are the secondary research questions/objectives if applicable? Please put this in language comprehensible to a lay person.**

What design factors should be considered when designing an application for people with dementia?

**A12. What is the scientific justification for the research? Please put this in language comprehensible to a lay person.**

The number of people who are suffering with dementia in the UK is rapidly increasing. With the increasing development of mobile applications, there is the opportunity to provide an app which could potentially aid the important reminiscence process, relevant in promoting well being in people with dementia. The aim of the project is to design and evaluate the effectiveness of this app. In order for the app to be useful for patients with dementia, a user-centred design process is essential. It is anticipated that the application will be used via a tablet PC. Whilst the current dementia sufferers will likely not have an in-depth knowledge of tablet PCs and apps, the next generation of sufferers will more likely consider them to be familiar objects.

**A13. Please summarise your design and methodology. It should be clear exactly what will happen to the research participant, how many times and in what order. Please complete this section in language comprehensible to the lay person. Do not simply reproduce or refer to the protocol. Further guidance is available in the guidance notes.**

This research will be split into 3 main phases - exploratory research, design and prototyping and testing & evaluation. At each phase, different participants will be used. Therefore, each participant will only have one intervention with the researcher. This will ensure that a broad range of opinions can be taken into account.

At each phase, some of the discussions will be audio-recorded, with the permission of all the participants. These recordings will be used to ensure that all information within my report is accurate and complete.

**1. Exploratory Research Stage**

The exploratory research will be in the form of a focus group, comprised of people with dementia, their carers and an experienced professional. It will be used to evaluate the basic requirements of the app before the designing stage commences. This will aid the researcher when designing the app prototypes. This focus group will be audio recorded.

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**2. App Design and Prototyping Stage**

During the design phase, the participants will be asked to evaluate a high-fidelity prototype, using the tablet PC. This will allow the users to visualise the functionality and layout of the app with ease. This will then be discussed (and modified if required) until the most agreeable design is found. All the discussions relating to the design of the system will be audio recorded.

**3. Testing and Evaluation Stage**

The testing and evaluation stage will be separated into two sections:

a. Group Testing Session - during this intervention, a reminiscence session will be conducted using the tablet PC. In order to facilitate this, the tablet will be connected to a larger TV screen. Once the session has been completed, the participants will be encouraged to discuss the impact they believe the app has made. Only the discussion relating to the app will be audio-recorded. The reminiscence session will not be recorded, but relevant, app-related observations will be recorded.

b. Individual Evaluation - this intervention will involve the use of the app within the home environment. The participants will take the app home for an agreed length of time (maximum length of 1 week). They will be encouraged to use the app as often as possible. Once the agreed time has passed, they will be invited to discuss the experience. The final discussion will be audio-recorded.

**A14-1. In which aspects of the research process have you actively involved, or will you involve, patients, service users, and/or their carers, or members of the public?**

- ☒ Design of the research
- ☒ Management of the research
- ☒ Undertaking the research
- ☐ Analysis of results
- ☐ Dissemination of findings
- ☐ None of the above

*Give details of involvement, or if none please justify the absence of involvement.*

The members of the focus group will comprise people with mild-to-moderate dementia, carers and professionals. The views of the focus group will inform the development of the prototype app. People with dementia will be involved in evaluating the prototype and finally the developed app will be tested and evaluated by other people with dementia.

**4. RISKS AND ETHICAL ISSUES****RESEARCH PARTICIPANTS****A17-1. Please list the principal inclusion criteria (list the most important, max 5000 characters).**

For the first phase, the principle inclusion criteria are as follows:

1. A diagnosis of mild-to-moderate dementia
2. Acknowledgement (at least occasionally) that they have a memory problem
3. Adequate communication skills to participate in group discussions
4. Willingness to attend and participate in a focus group

For the second phase, the principle inclusion criteria are as follows:

1. A diagnosis of mild-to-moderate dementia
2. Acknowledgement (at least occasionally) that they have a memory problem
3. Adequate communication skills to participate in group discussions
4. Willingness to attend and participate in a discussion of designs

For the group element of the third phase, the principle inclusion criteria are as follows:

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1. A diagnosis of mild-to-moderate dementia
2. Acknowledgement (at least occasionally) that they have a memory problem
3. Adequate communication skills to participate in group discussions
4. Willingness to attend and participate in reminiscence activities

For the individual element of the third phase, the principle inclusion criteria is as follows:

1. A diagnosis of mild-to-moderate dementia
2. Acknowledgement (at least occasionally) that they have a memory problem
3. Adequate communication skills to participate in group discussions
4. Willingness to complete reminiscence activities at home

**A17-2. Please list the principal exclusion criteria (list the most important, max 5000 characters).**

The principle exclusion criteria is as follows:

1. A diagnosis of severe dementia
2. Sensory impairment
3. Severe illness

**RESEARCH PROCEDURES, RISKS AND BENEFITS**
**A18. Give details of all non-clinical intervention(s) or procedure(s) that will be received by participants as part of the research protocol. These include seeking consent, interviews, non-clinical observations and use of questionnaires.**

Please complete the columns for each intervention/procedure as follows:

1. Total number of interventions/procedures to be received by each participant as part of the research protocol.
2. If this intervention/procedure would be routinely given to participants as part of their care outside the research, how many of the total would be routine?
3. Average time taken per intervention/procedure (minutes, hours or days)
4. Details of who will conduct the intervention/procedure, and where it will take place.

Intervention or procedure	1	2	3	4
Stage 1 - Focus Group	1	1	1 hour	This intervention will be conducted by the researcher, with a representative from the Alzheimer's Society present.
Stage 2 - Prototype testing	1	1	1 hour	This intervention will be conducted by the researcher, with a representative from the Alzheimer's Society present.
Stage 3 - Group Testing Session	1	1	1 hour	This intervention will be conducted by the researcher, with a representative from the Alzheimer's Society present. This will take place as part of an existing "Activity Club" which is run by the Alzheimer's Society.
Stage 3 - Individual Evaluation (Distribution of app)	1	1	1 hour	This intervention will be conducted by the researcher, with a representative from the Alzheimer's Society present. It will be conducted in the most convenient location for the person with dementia and their carer.
Stage 3 - Individual Evaluation (Final evaluation of app)	1	1	1 hour	This intervention will be conducted by the researcher, with a representative from the Alzheimer's Society present. It will be conducted in the most convenient location for the person with dementia and their carer.

**A19. Give details of any clinical intervention(s) or procedure(s) to be received by participants as part of the research protocol. These include uses of medicinal products or devices, other medical treatments or assessments, mental health interventions, imaging investigations and taking samples of human biological material. Include procedures which might be received as routine clinical care outside of the research.**

Please complete the columns for each intervention/procedure as follows:

1. Total number of interventions/procedures to be received by each participant as part of the research protocol.
2. If this intervention/procedure would be routinely given to participants as part of their care outside the research, how many of the total would be routine?

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3. Average time taken per intervention/procedure (minutes, hours or days).  
4. Details of who will conduct the intervention/procedure, and where it will take place.

Intervention or procedure	1	2	3	4
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**A20. Will you withhold an intervention or procedure, which would normally be considered a part of routine care?**

☐ Yes ☒ No

**A21. How long do you expect each participant to be in the study in total?**

A maximum of three months

**A22. What are the potential risks and burdens for research participants and how will you minimise them?**

*For all studies, describe any potential adverse effects, pain, discomfort, distress, intrusion, inconvenience or changes to lifestyle. Only describe risks or burdens that could occur as a result of participation in the research. Say what steps would be taken to minimise risks and burdens as far as possible.*

Whilst using the proposed app, the participants will be encouraged to discuss past memories. This may result in upsetting memories. The participants will be made aware that this is a risk, and will be given the opportunity to stop their participation in the research should this occur. At all times during the contact with the researcher, there will be both the participant's carer and also a representative from the Alzheimer's Society, who will have had prior interactions with the participant. The carer and the Alzheimer's Society representative will be able to comfort the person in order to reduce any distress which may have been caused by discussing upsetting memories, and intervene if necessary.

**A23. Will interviews/ questionnaires or group discussions include topics that might be sensitive, embarrassing or upsetting, or is it possible that criminal or other disclosures requiring action could occur during the study?**

☒ Yes ☐ No

*If Yes, please give details of procedures in place to deal with these issues:*

Whilst using the proposed app, the participants will be encouraged to discuss past memories. This may result in upsetting memories. The participants will be made aware that this is a risk, and will be given the opportunity to stop their participation in the research should this occur. At all times during the contact with the researcher, there will be both the participant's carer and also a representative from the Alzheimer's Society, who will have had prior interactions with the participant. The carer and the Alzheimer's Society representative will be able to comfort the person in order to reduce any distress which may have been caused by discussing upsetting memories, and intervene if necessary.

**A24. What is the potential for benefit to research participants?**

Reminiscence therapy (RT) has been shown to improve communication skills, promote well-being and increase self-awareness. In producing an effective mobile application that features reminiscence theory, the dementia sufferer will be able to have a rich source of memory prompts at their fingertips, without the need for cumbersome photo albums or boxes. In taking part in the research, the participant will be able to help drive a user-centred design process aimed at making the RT process easier and more beneficial.

In the best case scenario, there is a possibility of at least some temporary recovery of capacity.

**A25. What arrangements are being made for continued provision of the intervention for participants, if appropriate, once the research has finished? May apply to any clinical intervention, including a drug, medical device, mental health intervention, complementary therapy, physiotherapy, dietary manipulation, lifestyle change, etc.**

The nature of this research is essentially exploratory and concerned with a proof of concept. It is unlikely that any participant will gain significant benefit through their participation. In the event of some significant benefit being identified I would approach the AS to see whether a product might be made available.

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Upon request, the application could be provided using a tablet at a cost to the participant of approximately £100, the app itself would be provided free of charge.

**A26. What are the potential risks for the researchers themselves? (if any)**

There are occasions when the person with dementia may become aggressive. This can be part of the progression of the syndrome. The researcher does have prior experience of an aggressive dementia sufferer, and would be aware if the situation is leading in this direction. However, should the change in behaviour not be noticed immediately, there will be trained a Dementia Support Worker from the Alzheimer's Society present at all times.

**RECRUITMENT AND INFORMED CONSENT**

*In this section we ask you to describe the recruitment procedures for the study. Please give separate details for different study groups where appropriate.*

**A27-1. How will potential participants, records or samples be identified? Who will carry this out and what resources will be used? For example, identification may involve a disease register, computerised search of GP records, or review of medical records. Indicate whether this will be done by the direct healthcare team or by researchers acting under arrangements with the responsible care organisation(s).**

The participants will be identified through the Alzheimer's Society. All participants will be existing clients of the service. The Dementia Support Workers will be able to identify suitable participants based on their previous knowledge and interactions with the person with dementia and their carer.

**A27-2. Will the identification of potential participants involve reviewing or screening the identifiable personal information of patients, service users or any other person?**

☐ Yes ☒ No

*Please give details below:*

The researcher will have no access to personal data during the recruitment phase.

**A28. Will any participants be recruited by publicity through posters, leaflets, adverts or websites?**

☐ Yes ☒ No

**A29. How and by whom will potential participants first be approached?**

The potential participants will be identified by Alzheimer's Society staff and introduced to the researcher, with the agreement of their carer. No participant will be coerced into taking part, and they will be able to withdraw at any time.

**A30-1. Will you obtain informed consent from or on behalf of research participants?**

☒ Yes ☐ No

*If you will be obtaining consent from adult participants, please give details of who will take consent and how it will be done, with details of any steps to provide information (a written information sheet, videos, or interactive material). Arrangements for adults unable to consent for themselves should be described separately in Part B Section 6, and for children in Part B Section 7.*

*If you plan to seek informed consent from vulnerable groups, say how you will ensure that consent is voluntary and fully informed.*

Information sheets and consent forms will be provided to each of the participants (attached to this application). Their carer will be fully involved in the process and they will have the opportunity to ask any questions. Although the participants will have a dementia diagnosis (and therefore, be lacking in capacity) they will have good enough communication skills to understand written text and be able to discuss their opinions.

In the case where the person with dementia does not have the capacity to decide for themselves, their carer will act as

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the consultee. Should the carer not want this responsibility, the person with dementia will not be included in the study.

*If you are not obtaining consent, please explain why not.*

*Please enclose a copy of the information sheet(s) and consent form(s).*

**A30-2. Will you record informed consent (or advice from consultees) in writing?**

☒ Yes ☐ No

**A31. How long will you allow potential participants to decide whether or not to take part?**

All participants in each of the phases would have at least 1 week from receipt of the information sheet to seeking consent and subsequently participating.

**A32. Will you recruit any participants who are involved in current research or have recently been involved in any research prior to recruitment?**

☐ Yes  
☒ No  
☐ Not Known

**A33-1. What arrangements have been made for persons who might not adequately understand verbal explanations or written information given in English, or who have special communication needs? (e.g. translation, use of interpreters)**

As a student project, with no funding, sadly there is no budget for translation services and it would therefore be necessary to exclude non-English speaking people.

**A34. What arrangements will you make to ensure participants receive any information that becomes available during the course of the research that may be relevant to their continued participation?**

Not applicable - given the participative nature of this research, all participants will become aware of developments through the course of their participation.

**A35. What steps would you take if a participant, who has given informed consent, loses capacity to consent during the study? Tick one option only.**

- ☐ The participant and all identifiable data or tissue collected would be withdrawn from the study. Data or tissue which is not identifiable to the research team may be retained.
- ☐ The participant would be withdrawn from the study. Identifiable data or tissue already collected with consent would be retained and used in the study. No further data or tissue would be collected or any other research procedures carried out on or in relation to the participant.
- ☒ The participant would continue to be included in the study.
- ☐ Not applicable – informed consent will not be sought from any participants in this research.
- ☐ Not applicable – it is not practicable for the research team to monitor capacity and continued capacity will be assumed.

*Further details:*

As part of the progression of dementia, the participant's mental capacity will fluctuate throughout the course of the research. However, the majority of participants will only be required for 1 session during which they should not lose any further capacity.

At all times, as previously explained, both a carer and representative from the Alzheimer's society will be present to

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explain and support where necessary.

Please complete Part B, Section 6, giving further information about arrangements for including adults unable to consent for themselves.

#### CONFIDENTIALITY

In this section, personal data means any data relating to a participant who could potentially be identified. It includes pseudonymised data capable of being linked to a participant through a unique code number.

#### Storage and use of personal data during the study

**A36. Will you be undertaking any of the following activities at any stage (including in the identification of potential participants)?** *(Tick as appropriate)*

- ☐ Access to medical records by those outside the direct healthcare team
- ☐ Electronic transfer by magnetic or optical media, email or computer networks
- ☐ Sharing of personal data with other organisations
- ☐ Export of personal data outside the EEA
- ☐ Use of personal addresses, postcodes, faxes, emails or telephone numbers
- ☒ Publication of direct quotations from respondents
- ☐ Publication of data that might allow identification of individuals
- ☒ Use of audio/visual recording devices
- ☒ Storage of personal data on any of the following:
  - ☐ Manual files including X-rays
  - ☐ NHS computers
  - ☐ Home or other personal computers
  - ☒ University computers
  - ☐ Private company computers
  - ☒ Laptop computers

*Further details:*

Any quotes published will be made anonymous, to prevent identification of the participants.

Audio recording devices will be used to record the discussions of the app. However, this would be subject to consent and the participants will be given a copy for them to keep, should they want it. All research data will be documented in accordance with the data protection act, and participants will be identified using an ID number only.

**A38. How will you ensure the confidentiality of personal data?** *Please provide a general statement of the policy and procedures for ensuring confidentiality, e.g. anonymisation or pseudonymisation of data.*

All data will remain anonymous. If there are any quotes published, they will not include any names and there will be no way for an identification to be made by any person reading the report.

All research data will be documented in accordance with the data protection act, and participants will be identified using an ID number only.

**A40. Who will have access to participants' personal data during the study?** *Where access is by individuals outside the direct care team, please justify and say whether consent will be sought.*

There will be no personal data stored about the participants. The only data which will be included is any comments which have been made by the participant. This will only be accessed by the researcher.

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## Storage and use of data after the end of the study

**A43. How long will personal data be stored or accessed after the study has ended?**

- ☐ Less than 3 months  
☐ 3 – 6 months  
☐ 6 – 12 months  
☒ 12 months – 3 years  
☐ Over 3 years

*If longer than 12 months, please justify:*

This project is part of a PhD programme which lasts up to 3 years.

## INCENTIVES AND PAYMENTS

**A46. Will research participants receive any payments, reimbursement of expenses or any other benefits or incentives for taking part in this research?**

- ☐ Yes    ☒ No

**A47. Will individual researchers receive any personal payment over and above normal salary, or any other benefits or incentives, for taking part in this research?**

- ☐ Yes    ☒ No

**A48. Does the Chief Investigator or any other investigator/collaborator have any direct personal involvement (e.g. financial, share holding, personal relationship etc.) in the organisations sponsoring or funding the research that may give rise to a possible conflict of interest?**

- ☐ Yes    ☒ No

## NOTIFICATION OF OTHER PROFESSIONALS

**A49-1. Will you inform the participants' General Practitioners (and/or any other health or care professional responsible for their care) that they are taking part in the study?**

- ☐ Yes    ☒ No

*If Yes, please enclose a copy of the information sheet/letter for the GP/health professional with a version number and date.*

## PUBLICATION AND DISSEMINATION

**A50. Will the research be registered on a public database?**

*The Department of Health's Research Governance Framework for Health and Social Care and the research governance frameworks for Wales, Scotland and Northern Ireland set out the requirement for registration of trials. Furthermore: Article 19 of the World Medical Association Declaration of Helsinki adopted in 2008 states that "every clinical trial must be registered on a publicly accessible database before recruitment of the first subject"; and the International Committee of Medical Journal Editors (ICMJE) will consider a clinical trial for publication only if it has been registered in an appropriate registry. Please see guidance for more information.*

- ☐ Yes    ☒ No

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*Please give details, or justify if not registering the research.**Please ensure that you have entered registry reference number(s) in question A5-1.***A51. How do you intend to report and disseminate the results of the study? Tick as appropriate:**

- ☒ Peer reviewed scientific journals
- ☐ Internal report
- ☒ Conference presentation
- ☐ Publication on website
- ☐ Other publication
- ☐ Submission to regulatory authorities
- ☐ Access to raw data and right to publish freely by all investigators in study or by Independent Steering Committee on behalf of all investigators
- ☐ No plans to report or disseminate the results
- ☐ Other (please specify)

**A53. Will you inform participants of the results?**

☒ Yes   ☐ No

*Please give details of how you will inform participants or justify if not doing so.*

There will be an additional discussion with the participants once the study has been completed. They will also be given the opportunity to obtain a copy of the report, should they want it.

**5. Scientific and Statistical Review****A54. How has the scientific quality of the research been assessed? Tick as appropriate:**

- ☐ Independent external review
- ☐ Review within a company
- ☐ Review within a multi-centre research group
- ☐ Review within the Chief Investigator's institution or host organisation
- ☐ Review within the research team
- ☒ Review by educational supervisor
- ☐ Other

*Justify and describe the review process and outcome. If the review has been undertaken but not seen by the researcher, give details of the body which has undertaken the review:*

*For all studies except non-doctoral student research, please enclose a copy of any available scientific critique reports, together with any related correspondence.*

*For non-doctoral student research, please enclose a copy of the assessment from your educational supervisor/ institution.*

**A56. How have the statistical aspects of the research been reviewed? Tick as appropriate:**

- ☐ Review by independent statistician commissioned by funder or sponsor
- ☐ Other review by independent statistician
- ☐ Review by company statistician
- ☐ Review by a statistician within the Chief Investigator's institution
- ☐ Review by a statistician within the research team or multi-centre group

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- ☐ Review by educational supervisor
- ☐ Other review by individual with relevant statistical expertise
- ☒ No review necessary as only frequencies and associations will be assessed – details of statistical input not required

*In all cases please give details below of the individual responsible for reviewing the statistical aspects. If advice has been provided in confidence, give details of the department and institution concerned.*

Title Forename/Initials Surname

Department

Institution

Work Address

Post Code

Telephone

Fax

Mobile

E-mail

*Please enclose a copy of any available comments or reports from a statistician.*

**A57. What is the primary outcome measure for the study?**

Participant and carer reported benefit.

**A58. What are the secondary outcome measures? (if any)**

Usability evaluation of the mobile application (how easy is it for users to use the app)

**A59. What is the sample size for the research? How many participants/samples/data records do you plan to study in total? If there is more than one group, please give further details below.**

Total UK sample size: 62

Total international sample size (including UK):

Total in European Economic Area:

*Further details:*

The total sample size is 62 broken down as follows:

30 people with dementia,

30 carers

2 Dementia Support Workers from the Alzheimer's Society

During phase 1, there will be 22 participants (Two focus groups comprising of 5 people with dementia, 5 carers and a Dementia Support Worker).

In phase 2 there 10 participants will be used to evaluate the system prototypes, comprised of 5 people with dementia and their carers.

During the final stage, there will be 10 participants (5 people with dementia and their carers) taking part in the group testing session. There will then be 10 additional couples who will be invited to take the app home to be used over the course of a week.

**A60. How was the sample size decided upon? If a formal sample size calculation was used, indicate how this was done,**

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*giving sufficient information to justify and reproduce the calculation.*

Sample size was largely determined by convenience. The numbers are weighted towards the final stage of the project to assess the perceived effect on the wellbeing of the people with dementia and their carer.

**A61. Will participants be allocated to groups at random?**

☐ Yes ☒ No

**A62. Please describe the methods of analysis (statistical or other appropriate methods, e.g. for qualitative research) by which the data will be evaluated to meet the study objectives.**

During all 3 phases, the data obtained will be both qualitative and quantitative as indicators of perceived effective performance of the app.

**6. MANAGEMENT OF THE RESEARCH****A63. Other key investigators/collaborators. Please include all grant co-applicants, protocol co-authors and other key members of the Chief Investigator's team, including non-doctoral student researchers.**

	Title	Forename/Initials	Surname
	Miss	Claire	Ancient
Post	Research Student		
Qualifications	BSc in Mathematics with Computing MSc in Information Systems		
Employer	Student at University of Portsmouth		
Work Address	School of Computing Buckingham Building, Lion Terrace Portsmouth		
Post Code	PO1 3HE		
Telephone			
Fax			
Mobile			
Work Email	claire.ancient@myport.ac.uk		

	Title	Forename/Initials	Surname
	Mr	Adam	Afghan
Post	Final Year Student		
Qualifications			
Employer	Student at University of Portsmouth		
Work Address	School of Computing Buckingham Building, Lion Terrace Portsmouth		
Post Code	PO1 3HE		
Telephone			
Fax			
Mobile			
Work Email	mde90157@myport.ac.uk		

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## A64. Details of research sponsor(s)

## A64-1. Sponsor

## Lead Sponsor

- Status: ☐ NHS or HSC care organisation  
☒ Academic  
☐ Pharmaceutical industry  
☐ Medical device industry  
☐ Local Authority  
☐ Other social care provider (including voluntary sector or private organisation)  
☐ Other

Commercial status:

*If Other, please specify:*

## Contact person

Name of organisation University of Portsmouth  
Given name Denise  
Family name Teasdale  
Address University House, Winston Churchill Avenue  
Town/city Portsmouth  
Post code PO1 2UP  
Country UNITED KINGDOM  
Telephone  
Fax  
E-mail denise.teasdale@port.ac.uk

## Is the sponsor based outside the UK?

- ☐ Yes ☒ No

*Under the Research Governance Framework for Health and Social Care, a sponsor outside the UK must appoint a legal representative established in the UK. Please consult the guidance notes.*

## A65. Has external funding for the research been secured?

- ☐ Funding secured from one or more funders  
☐ External funding application to one or more funders in progress  
☒ No application for external funding will be made

What type of research project is this?

- ☒ Standalone project  
☐ Project that is part of a programme grant  
☐ Project that is part of a Centre grant  
☐ Project that is part of a fellowship/ personal award/ research training award  
☐ Other

Other – please state:

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**A67. Has this or a similar application been previously rejected by a Research Ethics Committee in the UK or another country?**

☐ Yes ☒ No

*Please provide a copy of the unfavourable opinion letter(s). You should explain in your answer to question A6-2 how the reasons for the unfavourable opinion have been addressed in this application.*

**A69-1. How long do you expect the study to last in the UK?**

Planned start date: 01/12/2012

Planned end date: 31/12/2015

Total duration:

Years: 3 Months: 0 Days: 30

**A71-2. Where will the research take place? (Tick as appropriate)**

- ☒ England  
☐ Scotland  
☐ Wales  
☐ Northern Ireland  
☐ Other countries in European Economic Area

Total UK sites in study 1

**Does this trial involve countries outside the EU?**

☐ Yes ☒ No

**A72. What host organisations (NHS or other) in the UK will be responsible for the research sites? Please indicate the type of organisation by ticking the box and give approximate numbers of planned research sites:**

- ☐ NHS organisations in England  
☐ NHS organisations in Wales  
☐ NHS organisations in Scotland  
☐ HSC organisations in Northern Ireland  
☐ GP practices in England  
☐ GP practices in Wales  
☐ GP practices in Scotland  
☐ GP practices in Northern Ireland  
☐ Social care organisations  
☐ Phase 1 trial units  
☐ Prison establishments  
☐ Probation areas  
☐ Independent hospitals  
☒ Educational establishments 1  
☐ Independent research units  
☒ Other (give details) 1  
 Alzheimer's Society Winchester Office

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Total UK sites in study:

2

**A75-1. What arrangements will be made to review interim safety and efficacy data from the trial? Will a formal data monitoring committee or equivalent body be convened?**

Not applicable

*If a formal DMC is to be convened, please forward details of the membership and standard operating procedures to the Research Ethics Committee when available. The REC should also be notified of DMC recommendations and receive summary reports of interim analyses.*

**A75-2. What are the criteria for electively stopping the trial or other research prematurely?**

Not applicable

**A76. Insurance/ indemnity to meet potential legal liabilities**

*Note: in this question to NHS indemnity schemes include equivalent schemes provided by Health and Social Care (HSC) in Northern Ireland*

**A76-1. What arrangements will be made for insurance and/or indemnity to meet the potential legal liability of the sponsor(s) for harm to participants arising from the management of the research? Please tick box(es) as applicable.**

*Note: Where a NHS organisation has agreed to act as sponsor or co-sponsor, indemnity is provided through NHS schemes. Indicate if this applies (there is no need to provide documentary evidence). For all other sponsors, please describe the arrangements and provide evidence.*

- ☐ NHS indemnity scheme will apply (NHS sponsors only)
- ☒ Other insurance or indemnity arrangements will apply (give details below)

Insurance is provided by the University of Portsmouth

Please enclose a copy of relevant documents.

**A76-2. What arrangements will be made for insurance and/ or indemnity to meet the potential legal liability of the sponsor(s) or employer(s) for harm to participants arising from the design of the research? Please tick box(es) as applicable.**

*Note: Where researchers with substantive NHS employment contracts have designed the research, indemnity is provided through NHS schemes. Indicate if this applies (there is no need to provide documentary evidence). For other protocol authors (e.g. company employees, university members), please describe the arrangements and provide evidence.*

- ☐ NHS indemnity scheme will apply (protocol authors with NHS contracts only)
- ☒ Other insurance or indemnity arrangements will apply (give details below)

Insurance is provided by the University of Portsmouth

Please enclose a copy of relevant documents.

**A76-3. What arrangements will be made for insurance and/ or indemnity to meet the potential legal liability of investigators/collaborators arising from harm to participants in the conduct of the research?**

*Note: Where the participants are NHS patients, indemnity is provided through the NHS schemes or through professional indemnity. Indicate if this applies to the whole study (there is no need to provide documentary evidence). Where non-NHS sites are to be included in the research, including private practices, please describe the arrangements which will be made at these sites and provide evidence.*

- ☐ NHS indemnity scheme or professional indemnity will apply (participants recruited at NHS sites only)

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☒ Research includes non-NHS sites (give details of insurance/ indemnity arrangements for these sites below)

Insurance is provided by the University of Portsmouth

*Please enclose a copy of relevant documents.***A77. Has the sponsor(s) made arrangements for payment of compensation in the event of harm to the research participants where no legal liability arises?**☐ Yes ☒ No*Please enclose a copy of relevant documents.*

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**B. All research other than CTIMPs***In this sub-section, an adult means a person aged 16 or over.***B1. What impairing condition(s) will the participants have?***The study must be connected to this condition or its treatment.*

The participants will have mild-to-moderate Dementia.

**B2. Justify the inclusion of adults unable to consent for themselves. It should be clear why the research could not be carried out as effectively if confined to adults capable of giving consent.**

This research is a study to observe whether a reminiscence-based mobile application would be suitable for use by people with dementia and their carers. By not including adults with a diagnosis of dementia in the initial stages (exploratory, design and prototyping stages) of the research, the resulting product may not fulfil their complex needs. If people with dementia were excluded from the evaluative stage of the research, we would not be able to assess whether the app is perceived as effective.

**B3. Who in the research team will decide whether or not the participants have the capacity to give consent? What training/experience will they have to enable them to reach this decision?**

At all times during the contact with the researcher, there will be both the participant's carer and also a representative from the Alzheimer's Society, who will have had prior interactions with the participant. The carer and the Alzheimer's Society representative will be able to comfort the person in order to reduce any distress which may have been caused by discussing upsetting memories, and intervene if necessary.

**B4. Does the research have the potential to benefit participants who are unable to consent for themselves?**☒ Yes ☐ No*If Yes, please indicate the nature of this benefit. You may refer back to your answer to Question A24.*

Reminiscence Therapy has been shown to improve communication skills, promote well-being and increase self-awareness. In producing an effective mobile application that features reminiscence theory, the dementia sufferer will be able to have a rich source of memory prompts at their fingertips, without the need for cumbersome photo albums or boxes. In taking part in the research, the participant will be able to help drive a user-centred design process aimed at making the RT process easier and more beneficial.

In the best case scenario, there is a possibility of at least some temporary recovery of capacity.

**B5. Will the research contribute to knowledge of the causes or the treatment or care of persons with the same impairing condition (or a similar condition)?**☒ Yes ☐ No*If Yes, please explain how the research will achieve this:*

This research will facilitate a user-centred design process in the development of a reminiscence-based app and assess its potential benefit for people with dementia. The aim of the app is to perform a similar function to reminiscence therapy to help empower people with dementia who may be otherwise deprived as a result of limited resources or reduced mobility. Reminiscence therapy has been shown to improve the well-being, communication and sense of self for sufferers of dementia.

**B6. Will the research involve any foreseeable risk or burden for these participants, or interfere in any way with their freedom of action or privacy?**☐ Yes ☒ No

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**Questions B7 and B8 apply to any participants recruited in England and Wales.****B7. What arrangements will be made to identify and consult persons able to advise on the presumed wishes and feelings of participants unable to consent for themselves and on their inclusion in the research?**

The person with dementia will not be included in the research without consulting their carer, who will be expected to act as a consultee. The carer will be living with the participant and will be able to advise on their presumed wishes and feelings.

If the carer does not want the responsibility of acting as a consultee, the person with dementia will not be included in the study.

*Please enclose a copy of the written information to be provided to consultees. This should describe their role under section 32 of the Mental Capacity Act and provide information about the research similar to that which might be given to participants able to consent for themselves.*

**B8. Is it possible that a participant requiring urgent treatment might need to be recruited into research before it is possible to identify and consult a person under B7?**

☐ Yes ☒ No

*If Yes, say whether arrangements will be made instead to seek agreement from a registered medical practitioner and outline these arrangements. Or, if this is also not feasible, outline how decisions will be made on the inclusion of participants and what arrangements will be made to seek consent from the participant (if capacity has been recovered) or advice from a consultee as soon as practicable thereafter.*

**B9. What arrangements will be made to continue to consult such persons during the course of the research where necessary?**

The consultee will be continuously involved.

**B10. What steps will you take, if appropriate, to provide participants who are unable to consent for themselves with information about the research, and to consider their wishes and feelings?**

At no point will the researcher be in contact with the participant without their carer and a representative of the Alzheimer's Society. The carer will have a knowledge of the person with dementia's wishes and feelings. There will also be an information sheet provided to every participant. The participant will be able to withdraw from the research at any point (the consultee can also withdraw the participant on their behalf).

**B11. Is it possible that the capacity of participants could fluctuate during the research? How would this be handled?**

As part of the progression of dementia, the participant's mental capacity will fluctuate throughout the course of the research. The study will intentionally recruit participants for whom transitions between capacity and incapacity are likely. However, the majority of participants will only be required for 1 session during which they should not lose any further capacity.

At all times, as previously explained, both a carer and representative from the Alzheimer's society will be present to explain and support where necessary.

**B12-1. What will be the criteria for withdrawal of participants?**

The withdrawal criteria is as follows:

1. The person with dementia decides to leave the study
2. The carer decides to withdraw the participants
3. The capacity of the participant is considered to have significantly declined.

**B13. Describe what steps will be taken to ensure that nothing is done to which participants appear to object (unless it is to protect them from harm or minimise pain or discomfort).**

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If the participant appears to object, they will be removed from the research. This will be judged by the consultee and the Alzheimer's Society representative in conjunction with the researcher.

**B14. Describe what steps will be taken to ensure that nothing is done which is contrary to any advance decision or statement by the participant?**

The consultee will be aware of the best interests and advance decisions of the participant. It will be expected that the consultee will act in an appropriate manner.

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**PART C: Overview of research sites**

**Please enter details of the host organisations (Local Authority, NHS or other) in the UK that will be responsible for the research sites.** For NHS sites, the host organisation is the Trust or Health Board. Where the research site is a primary care site, e.g. GP practice, please insert the host organisation (PCT or Health Board) in the Institution row and insert the research site (e.g. GP practice) in the Department row.

Research site		Investigator/ Collaborator/ Contact	
Institution name	University of Portsmouth	Title	Dr
Department name	School of Computing	First name/ Initials	Alice
Street address	Buckingham Building	Surname	Good
Town/city	Portsmouth		
Post Code	PO1 3AE		
Institution name	Alzheimer's Society	Title	Mr
Department name	Winchester Office	First name/ Initials	Mark
Street address	The Coach House, St Waleric, Park Road	Surname	Green
Town/city	Winchester		
Post Code	SO23 7BE		

Date: 09/11/2012

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**PART D: Declarations****D1. Declaration by Chief Investigator**

1. The information in this form is accurate to the best of my knowledge and belief and I take full responsibility for it.
2. I undertake to abide by the ethical principles underlying the Declaration of Helsinki and good practice guidelines on the proper conduct of research.
3. If the research is approved I undertake to adhere to the study protocol, the terms of the full application as approved and any conditions set out by review bodies in giving approval.
4. I undertake to notify review bodies of substantial amendments to the protocol or the terms of the approved application, and to seek a favourable opinion from the main REC before implementing the amendment.
5. I undertake to submit annual progress reports setting out the progress of the research, as required by review bodies.
6. I am aware of my responsibility to be up to date and comply with the requirements of the law and relevant guidelines relating to security and confidentiality of patient or other personal data, including the need to register when necessary with the appropriate Data Protection Officer. I understand that I am not permitted to disclose identifiable data to third parties unless the disclosure has the consent of the data subject or, in the case of patient data in England and Wales, the disclosure is covered by the terms of an approval under Section 251 of the NHS Act 2006.
7. I understand that research records/data may be subject to inspection by review bodies for audit purposes if required.
8. I understand that any personal data in this application will be held by review bodies and their operational managers and that this will be managed according to the principles established in the Data Protection Act 1998.
9. I understand that the information contained in this application, any supporting documentation and all correspondence with review bodies or their operational managers relating to the application:
  - Will be held by the REC (where applicable) until at least 3 years after the end of the study; and by NHS R&D offices (where the research requires NHS management permission) in accordance with the NHS Code of Practice on Records Management.
  - May be disclosed to the operational managers of review bodies, or the appointing authority for the REC (where applicable), in order to check that the application has been processed correctly or to investigate any complaint.
  - May be seen by auditors appointed to undertake accreditation of RECs (where applicable).
  - Will be subject to the provisions of the Freedom of Information Acts and may be disclosed in response to requests made under the Acts except where statutory exemptions apply.
10. I understand that information relating to this research, including the contact details on this application, may be held on national research information systems, and that this will be managed according to the principles established in the Data Protection Act 1998.
11. Where the research is reviewed by a REC within the UK Health Departments Research Ethics Service, I understand that the summary of this study will be published on the website of the National Research Ethics Service (NRES), together with the contact point for enquiries named below. Publication will take place no earlier than 3 months after issue of the ethics committee's final opinion or the withdrawal of the application.

**Contact point for publication***(Not applicable for R&D Forms)*

*NRES would like to include a contact point with the published summary of the study for those wishing to seek further information. We would be grateful if you would indicate one of the contact points below.*

- ☐ Chief Investigator
- ☐ Sponsor

Date: 09/11/2012

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- ☐ Study co-ordinator  
☒ Student  
☐ Other – please give details  
☐ None

**Access to application for training purposes** (Not applicable for R&D Forms)*Optional – please tick as appropriate:*

☒ I would be content for members of other RECs to have access to the information in the application in confidence for training purposes. All personal identifiers and references to sponsors, funders and research units would be removed.

This section was signed electronically by Dr Alice Good on 12/11/2012 11:32.

Job Title/Post: Senior Lecturer

Organisation: University

Email: alice.good@port.ac.uk

Signature: .....

Print Name: Alice Good

Date: 09/05/2012 (dd/mm/yyyy)

NHS REC Form

Reference:  
12/SC/0670

IRAS Version 3.4

**D2. Declaration by the sponsor's representative**

*If there is more than one sponsor, this declaration should be signed on behalf of the co-sponsors by a representative of the lead sponsor named at A64-1.*

I confirm that:

1. This research proposal has been discussed with the Chief Investigator and agreement in principle to sponsor the research is in place.
2. An appropriate process of scientific critique has demonstrated that this research proposal is worthwhile and of high scientific quality.
3. Any necessary indemnity or insurance arrangements, as described in question A76, will be in place before this research starts. Insurance or indemnity policies will be renewed for the duration of the study where necessary.
4. Arrangements will be in place before the study starts for the research team to access resources and support to deliver the research as proposed.
5. Arrangements to allocate responsibilities for the management, monitoring and reporting of the research will be in place before the research starts.
6. Where the research is reviewed by a REC within the UK Health Departments Research Ethics Service, I understand that the summary of this study will be published on the website of the National Research Ethics Service (NRES), together with the contact point for enquiries named in this application. Publication will take place no earlier than 3 months after issue of the ethics committee's final opinion or the withdrawal of the application.

This section was signed electronically by Mrs Denise Teasdale on 13/11/2012 10:15.

Job Title/Post: Research Manager  
Organisation: University of Portsmouth  
Email: denise.teasdale@port.ac.uk

NHS REC Form

Reference:  
12/SC/0670

IRAS Version 3.4

**D3. Declaration for student projects by academic supervisor(s)**

1. I have read and approved both the research proposal and this application. I am satisfied that the scientific content of the research is satisfactory for an educational qualification at this level.
2. I undertake to fulfil the responsibilities of the supervisor for this study as set out in the Research Governance Framework for Health and Social Care.
3. I take responsibility for ensuring that this study is conducted in accordance with the ethical principles underlying the Declaration of Helsinki and good practice guidelines on the proper conduct of research, in conjunction with clinical supervisors as appropriate.
4. I take responsibility for ensuring that the applicant is up to date and complies with the requirements of the law and relevant guidelines relating to security and confidentiality of patient and other personal data, in conjunction with clinical supervisors as appropriate.

**Academic supervisor 1**

This section was signed electronically by Dr Alice Good on 12/11/2012 11:33.

Job Title/Post: Senior Lecturer  
Organisation: University  
Email: alice.good@port.ac.uk

Date: 09/11/2012

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#### A.3.4.2 Study Protocol

## Research Protocol

Dr Alice Good, Claire Ancient, Adam Afghan  
University of Portsmouth, School of Computing  
NHS REC Reference No:

### Mobile Application to Aid Reminiscence in Dementia Patients\*

#### RESEARCH SUMMARY

It has been shown that reminiscence therapy (RT) can have a positive effect on people with dementia. This research is a study to assess whether a tablet PC based application which utilises RT, can be used to benefit people with dementia. The aim of the project is to produce an application (app) which can act as storage for 'positive memories', in a range of media types (including pictures and audio).

The initial stages of this research have been designed to ensure that all the needs of the users are taken into account, by fully involving them when developing the app. Once the app has been produced, the research will then focus on the perceived effectiveness of the app together with its usability.

#### BACKGROUND OF PROJECT

Dementia is a devastating, progressive condition. It robs people of their most precious memories, and steals loved ones away. By the Prime Minister's own admission, dementia has become a national crisis (Cameron, 2012). Currently, about 800,000 people are living with this cruel condition in the UK alone (Alzheimer's Society, 2012). The most common symptoms of dementia are memory loss, mood changes, difficulty with reasoning and problems with communication. Lack of communication skills can frequently leave the person with dementia feeling isolated which often leads to a reduced quality of life.

The number of people with dementia is increasing at a rapid rate. With no cure on the horizon, there needs to be research into the various techniques which can be utilised to deal with the extremely distressing effects of this illness. RT is one possible solution. With regard to memory loss, often the long-term recollections remain intact for longer than the short-term memory. RT draws on this, using memory aids such as photos and music to encourage people to discuss their early memories. It has been shown that RT can improve well-being, support communication and therefore, promote social inclusion, not only for the person with dementia, but also their caregivers (Alm et al., 2004). RT can be seen as a tool which supports interaction between the person with dementia and the people around them. Currently, RT requires a considerable investment in both time and money in order to gather a sufficient quantity of memory prompts, this often discourages people from running RT sessions.

With the increasing prevalence of mobile devices, it seems logical to combine RT with new technologies.

\* Whilst there are many different types of dementia, there is no need to differentiate between the various conditions for this study.

**EXPERIMENTAL DESIGN AND METHODS**

The research will be carried out in three phases:

1. Exploratory Research Stage - this will involve a focus group comprising of people with dementia, carers and professionals who regularly work with dementia sufferers. It will be used to identify and explore the needs of both the carer and the person with dementia when designing an app.
2. Designing and Prototyping Stage - once the initial design has been completed, paper-based low fidelity prototyping will take place with people with dementia and their carers. Once this is completed and the necessary changes to the design are made, high fidelity testing will take place using the tablet PC.
3. Testing and Evaluation Stage - this testing and evaluation stage will have two different evaluation methods. Firstly, a group evaluation will take place where couples will attend to discuss their thoughts on the outcome together with an initial assessment of the usability both from the point of view of the carer and the person with dementia. The app will then be given to two couples for use in their own home over the course of a week. Once this testing period is over, both participants will be encouraged to discuss whether they felt the app proved beneficial.

**AIMS AND OBJECTIVES**

The main aim of this research is to assess the feasibility of using a tablet PC and app to utilise reminiscence therapy and subsequently evaluate the perceived effect on the wellbeing of the person with dementia and their carer.

During the first stage of the research (exploratory research), the aim is to assess the needs of both the person with dementia and the carer in order to facilitate the effective design of the app. Once this has been completed, the aim of the second stage is to ensure that these needs are sufficiently incorporated into the design of the app. In the final testing stage to aim is to evaluate the perceived effectiveness of the app within both a communal and residential environment.

**ETHICAL CONSIDERATIONS**

By including people with dementia, the Mental Capacity Act 2005 must be considered and followed. Due to the progression of dementia, it is possible that some participants will lack capacity or have fluctuating capacity. If the person with dementia is judged to not have the capacity to decide whether or not to take part, their carer will act as the consultee. By its very nature, this research focuses on transitions between capacity and incapacity and vice versa; it will therefore be necessary to recruit people lacking capacity who nevertheless have some prospect of regaining some capacity.

During the course of the final stage of this research, the participants will be encouraged to discuss past memories. Some of these memories may be upsetting and could, as a result, cause some distress and/or discomfort.

All participants will be recruited through and with the support of the Alzheimer's Society (AS). There will also be a Dementia Support Worker who is employed by the AS present at all interactions between the researcher, the participants and their carers.

**BENEFITS**

Reminiscence therapy has been shown to have a positive effect on the wellbeing, communication skills and mood of people with dementia. Currently, due to the large number of resources required, it is difficult to provide reminiscence therapy sessions on a more tailored, one-to-one basis using memory prompts which are personal to the participants. This research has the potential to help the facilitation of reminiscence therapy sessions which are specific to the individuals taking part.

This research could also help people with dementia who have limited mobility and/or struggle to attend organised reminiscence therapy sessions on a regular basis. The app could provide facilitation of reminiscence therapy within the individual's home environment in order to promote and support a feeling of wellbeing for the person with dementia and their carer.

The outcome of this research could be a more prevalent use of reminiscence therapy within an individual's home environment as well as potentially in both residential and non-residential care facilities.

**RESOURCES AND COSTS**

The main resource which is required for this project is tablet PCs. The cost of these devices will start at £100. The research team already owns one device; however, funding is being sourced to purchase more in order to enable parallel user testing in the evaluative stage of the study.

**REFERENCES**

- Alm, N., Astell, A., Ellis, M., Dye, R., Gowans, G., & Campbell, J. (2004). A cognitive prosthesis and communication support for people with dementia. *Neuropsychological Rehabilitation*, 14(1-2), 117-134.
- Cameron, D. (2012). Transcript: Prime Minister's Speech to the Dementia 2012 Conference Retrieved 27th April, 2012, from <http://www.number10.gov.uk/news/transcript-prime-ministers-speech-to-the-dementia-2012-conference/>
- Alzheimer's Society. (2012). What is Dementia? Retrieved 14th April, 2012, from [http://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=106](http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=106)

**A.3.4.3 Provisional Opinion Letter****NRES Committee South Central - Berkshire**

Bristol REC Centre  
Whitefriars  
Level 3, Block B  
Lewins Mead  
Bristol  
BS1 2NT

Telephone: 0117 3421389  
Facsimile: 0117 3420445

21 December 2012

Dr Alice Good  
Lecturer  
University of Portsmouth  
School of Computing  
Buckingham Building, Lion Terrace  
Portsmouth, PO1 3HE

Dear Dr Good,

**Study Title:** Mobile Application to Aid Reminiscence in Dementia Patients  
**REC reference:** 12/SC/0670  
**IRAS project ID:** 106190

The Research Ethics Committee reviewed the above application at the meeting held on 18 December 2012. Thank you for attending to discuss the application.

**Documents reviewed**

The documents reviewed at the meeting were:

<i>Document</i>	<i>Version</i>	<i>Date</i>
Evidence of insurance or indemnity	Zurich: Period until 31.07.2013	20 July 2012
Investigator CV	Dr Good	
Investigator CV	Claire Ancient	
Investigator CV	Adam Afghan	
Other: Letter from Winchester office of Alzheimer's Society		11 July 2012
Participant Consent Form		01 October 2012
Participant Consent Form: Consultees		01 October 2012
Participant Information Sheet	4	01 October 2012
Participant Information Sheet: Consultees	4	01 October 2012
Protocol	3	01 October 2012
REC application		13 November 2012
Referees or other scientific critique report		16 November 2012

A Research Ethics Committee established by the Health Research Authority

**Provisional opinion**

After the Committee's initial discussions you and Ms Ancient were invited to join the meeting to clarify the following issues:

1. The Committee asked you to justify involving patients who lack capacity.  
  
Your initial response was that the app was designed to be used with this group; however after further discussion you agreed that adults lacking capacity should not and would not be involved in the first two phases of the study. Further discussion revealed that it was essential to involve people with dementia and their carers in this study which broadly aimed to develop an app, which might be useful to them, however it was less clear as to whether it was essential to involve people lacking capacity. You both explained the benefits of the proposed research related to people with dementia and consequent memory loss. The Committee agreed but pointed out that memory loss does not automatically lead to loss of capacity. It questioned if patients without capacity were required in the developing phase; it understood that they would need to be involved in testing the developed app, but this was beyond the immediate scope of the proposed study. You both confirmed you did not need to include participants that lacked capacity in your study which was focused on designing the app. The Committee pointed out that this was not clear in the submitted application.
2. The Committee requested clarification on the use of the app; whether it would it be used by the carer in the company of the patient or by the patient alone. You both replied that the app was to be used as a conversation aid and a reference point; it was a requirement that the app would be used by the carer and participant, never to be used by the participant alone.
3. The committee asked if the app software programme would be limited to the participant's personal experience. You both confirmed this.
4. The Committee questioned if you had gained the support of the Winchester Alzheimer's Support Network. You both confirmed this. The Committee queried why no documentation, such as the invitation letters, were included with the application. You both explained that you could not produce these documents until you gained NHS approval. The Support Network's approval was contingent upon a favourable NHS opinion.
5. The Committee queried the timing between the phases. You both replied that the study was a doctorate and had time constraints. The study would need to be completed in year two. Year one would involve the design whilst year two could concentrate on gathering data.
6. The Committee requested clarification of the various PISs. You both replied that the carers/consultee and patients would receive a separate PIS. The Committee pointed out that you needed to create a further one for the support worker, worded specifically for this cohort. You both agreed.



7. The Committee observed that the Consent Form did not include a clause stating that anonymous quotes could be used and/or published. You both to include one.
8. The Committee queried what other past studies had already been completed in this specific area. You both replied that a study in Dundee used touch screen interaction; the content of the programme included generic, local references. The app. you intended to design would be personalised, because other research has shown that personal reminiscence has more of an effect than generic references.
9. The Committee questioned the proposed quantitative analysis; it queried how you intended to measure the success of the app. You both replied that you would be measuring the perceived benefit from the perspectives of both the carer and the patient largely by collecting qualitative data.
10. The Committee requested that the PISs be rewritten in layman's language. You both agreed.

After you both left the room the Committee discussed the following:

The Committee concluded that it was not necessary to involve people lacking capacity in this study, in its current design. It was possible and indeed desirable, that people with Alzheimer's and their carers should be involved in the study but there would be no need to involve any participant lacking capacity. This decision is broadly in line with two of the five underlying principles of the Act. Firstly people with Alzheimer's will be assumed to have capacity and not judged to be lacking it merely due to their diagnosis. Secondly participants' involvement in the design of the app. would effectively assist them in sustaining capacity thus ensuring that every attempt is made to facilitate decision making. In summary, phases 1 and 2 of the study would only be able to proceed with participants who have capacity. In phase 3, the participant's consent would be required when taking a tablet computer home, complete with app. in order to evaluate it in the company of their carer.

The Committee reasoned that once fully developed, it might be useful to test the app. involving people lacking capacity but this was beyond the scope of the study. This additional investigation could be applied for via a MCA notice of substantial amendment or it might be constructed as a new study.

The Committee would be content to give a favourable ethical opinion of the research, subject to receiving a complete response to the request for further information set out below.

Authority to consider your response and to confirm the Committee's final opinion has been delegated to the Chair.

**Further information or clarification required:**

1. Reassurance that people lacking capacity would not be recruited to this study.  
The Committee recognised the likelihood that some participants might lose capacity in the course of the study thus preventing their continuing involvement; it is therefore essential that consent is obtained to retain and continue to use data in the event of loss of capacity.
2. Please rewrite the PISs in layman's language.
3. Please include explanations with regard to audio recording in the PISs.
4. Corrections/amendments to the Consent Form:
  - a. Please add a clause requesting consent for audio recording.
  - b. Please add a clause requesting consent for the publication of direct quotes in anonymous form.
  - c. Please ensure that you obtain consent for the retention and future use of data in the event of the participant losing capacity
5. Please create a support staff PIS and Consent Form.

**If you would find it helpful to discuss any of the matters raised above or seek further clarification from a member of the Committee, you are welcome to contact Rae Granville on 0117 3421389.**

When submitting your response to the Committee, please send revised documentation where appropriate underlining or otherwise highlighting the changes you have made and giving revised version numbers and dates.

If the committee has asked for clarification or changes to any answers given in the application form, please do not submit a revised copy of the application form; these can be addressed in a covering letter to the REC.

The Committee will confirm the final ethical opinion within a maximum of 60 days from the date of initial receipt of the application, excluding the time taken by you to respond fully to the above points. A response should be submitted by no later than 20 January 2013.

**Membership of the Committee**


The members of the Committee who were present at the meeting are listed on the attached sheet.

**Statement of compliance**

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

**12/SC/0670****Please quote this number on all correspondence**

Yours sincerely,

A handwritten signature in black ink, appearing to be 'D. Carpenter', with a long horizontal stroke extending to the right.**Mr David Carpenter**  
**Chair**Email: [nrescommittee.southcentral-berkshire@nhs.net](mailto:nrescommittee.southcentral-berkshire@nhs.net)

*Enclosures:                      List of names and professions of members who were present at the meeting and those who submitted written comments.*

*Copy to:                          Mrs Denise Teasdale*

**NRES Committee South Central - Berkshire****Attendance at Committee meeting on 18 December 2012****Committee Members:**

<i>Name</i>	<i>Profession</i>	<i>Present</i>	<i>Notes</i>
Dr Kuna Aiyysamy	Senior Dental Officer	No	
Mr David Carpenter	Social Scientist	Yes	
Dr Mike Emanuel	Pharmaceutical Consultant	Yes	
Mr Richard Havelock	Retired Clinical Director	Yes	
Mrs Liz Hunter	Retired Midwife and Clinical Governance Manager	Yes	
Dr Vandana Luthra	R&D Research Co-ordinator	Yes	
Mr Richard Merewood	Director	Yes	
Dr Joanne Philpot	Consultant Paediatrician	Yes	
Mike Proven	Co-ordinator for QA in Research	Yes	
Ms Ann Quinn	Head of the School of Health and Social Care	No	
Mr Donald Scott-Collett	Lead Pharmacist for Elderly Care, Neuro-rehabilitation, Dermatology and Clinical Governance	Yes	
Ms Susan Tonks	Senior Research Support Associate	Yes	

**Also in attendance:**

<i>Name</i>	<i>Position (or reason for attending)</i>
Ms Rae Granville	Committee Co-ordinator
Chandni Motala	Observer

**Written comments received from:**

<i>Name</i>	<i>Position</i>
Ms Ann Quinn	Head of the School of Health and Social Care

**A.3.4.4 Reply to REC**

School of Computing  
University of Portsmouth  
Buckingham Building Lion  
Terrace  
Portsmouth PO1 3HE  
United Kingdom

T: +44 (0)23 9284 6363 F:  
+44 (0)23 9284 6364

15<sup>th</sup> January 2013

Mr David Carpenter  
Chair  
NRES Committee South Central – Berkshire  
Bristol REC Centre  
Whitefriars  
Level 3, Block B  
Lewins Mead  
Bristol  
BS1 2NT

Dear Mr Carpenter,

**Study Title:** Mobile Application to Aid Reminiscence in Dementia Patients  
**REC Reference:** 12 / SC / 0670  
**IRAS Project ID:** 106190

Thank you for your response, dated 21<sup>st</sup> December 2012, to the above application for ethical review.

Please see my comments below:

1. Reassurance that people lacking capacity would not be recruited to this study.  
The Committee recognised the likelihood that some participants might lose capacity in the course of the study thus preventing their continuing involvement; it is therefore essential that consent is obtained to retain and continue to use data in the event of loss of capacity.

*People lacking capacity, at the point of consent will not be included within this study. Should the participant lose capacity during the course of the study, they will be removed but their data retained (with their consent, as per appendix D).*

2. Please rewrite the PISs in layman's language.

*Please see enclosed participant information sheets (appendices A and C) for both people with dementia and their carer, re-written in layman's language.*

3. Please include explanations with regard to audio recording in the PISs.

*An additional section has been added to all participant information sheets explaining the use of audio recordings (appendices A, C and E).*

4. Corrections/amendments to the Consent Form:
  - a. Please add a clause requesting consent for audio recording.
  - b. Please add a clause requesting consent for the publication of direct quotes in anonymous form.
  - c. Please ensure that you obtain consent for the retention and future use of data in the event of the participant losing capacity

*Please see enclosed amended consent forms for both the people with dementia and their carers (appendices B and D), with the above additional clauses.*

5. Please create a support staff PIS and Consent Form.

*Please see enclosed a participant information sheet and consent form for support staff, written in layman's language (appendices E and F).*

Should you require any further clarification or additional information please do not hesitate to contact us.

Yours sincerely,

Dr. Alice Good and Claire Ancient

**A.3.4.5 Final Opinion Letter****NRES Committee South Central - Berkshire**

Bristol REC Centre  
Whitefriars  
Level 3, Block B  
Lewins Mead  
Bristol  
BS1 2NT

Telephone: 0117 3421389  
Facsimile: 0117 3420445

21 January 2013

Dr Alice Good  
Lecturer  
University of Portsmouth  
School of Computing  
Buckingham Building, Lion Terrace  
Portsmouth  
PO1 3HE

Dear Dr Good,

**Study title:** Mobile Application to Aid Reminiscence in Dementia Patients  
**REC reference:** 12/SC/0670  
**IRAS project ID:** 106190

Thank you for your letter of 15 January 2013, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

We plan to publish your research summary wording for the above study on the NRES website, together with your contact details, unless you expressly withhold permission to do so. Publication will be no earlier than three months from the date of this favourable opinion letter. Should you wish to provide a substitute contact point, require further information, or wish to withhold permission to publish, please contact the Co-ordinator Ms Rae Granville, [nrescommittee.southcentral-berkshire@nhs.net](mailto:nrescommittee.southcentral-berkshire@nhs.net).

**Confirmation of ethical opinion**

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

**Mental Capacity Act 2005**

The committee did not approve this research project for the purposes of the Mental Capacity Act

A Research Ethics Committee established by the Health Research Authority

2005. The research may not be carried out on, or in relation to, a person who lacks capacity to consent to taking part in the project.

### Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study:

1. Please include the full name of the REC, 'South Central - Berkshire', before the NRES number in the 'Who has reviewed the study?' section of all the PIS'.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

*Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.*

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at <http://www.rdforum.nhs.uk>.

*Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.*

*For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.*

*Sponsors are not required to notify the Committee of approvals from host organisations*

**It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).**

**You should notify the REC in writing once all conditions have been met (except for site approvals from host organisations) and provide copies of any revised documentation with updated version numbers. The REC will acknowledge receipt and provide a final list of the approved documentation for the study, which can be made available to host organisations to facilitate their permission for the study. Failure to provide the final versions to the REC may cause delay in obtaining permissions.**

### Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Evidence of insurance or indemnity	Zurich: Period until 31.07.2013	20 July 2012
Investigator CV	Dr Good	
Investigator CV	Claire Ancient	
Investigator CV	Adam Afghan	
Other: Letter from Winchester office of Alzheimer's Society		11 July 2012



Participant Consent Form: Carer	5	01 January 2013
Participant Consent Form: Person with Dementia	5	01 January 2013
Participant Consent Form: Support Worker	5	01 January 2013
Participant Information Sheet: Carer	5	01 January 2013
Participant Information Sheet: Person with Dementia	5	01 January 2013
Participant Information Sheet: Support Worker	5	01 January 2013
Protocol	3	01 October 2012
REC application		13 November 2012
Referees or other scientific critique report		16 November 2012
Response to Request for Further Information		15 January 2013

### Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

### After ethical review

#### Reporting requirements

The attached document “*After ethical review – guidance for researchers*” gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The NRES website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

#### Feedback

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the website.

Further information is available at National Research Ethics Service website > After Review

**12/SC/0670****Please quote this number on all correspondence**

We are pleased to welcome researchers and R & D staff at our NRES committee members' training days – see details at <http://www.hra.nhs.uk/hra-training/>

With the Committee's best wishes for the success of this project.

Yours sincerely,



**Mr David Carpenter**  
**Chair**

Email: [nrescommittee.southcentral-berkshire@nhs.net](mailto:nrescommittee.southcentral-berkshire@nhs.net)

*Enclosures:*                      After ethical review – guidance for  
researchers

*Copy to:*                         *Mrs Denise Teasdale*

### A.3.5 School of Computing Referral Certificate



## Certificate of Ethics Review

<b>Project Title:</b>	Mobile Application to Aid Reminiscence in Dementia Patients
<b>User ID:</b>	527922
<b>Name:</b>	Claire Ancient
<b>Application Date:</b>	08/01/2015 11:54:52

You must download your certificate, print a copy and keep it as a record of this review.

You should **submit your certificate to the administrator of your Faculty Ethics Committee for further review.**

The chair person of the Technology Faculty Ethics Committee is John Williams.

It is your responsibility to adhere to the University Ethics Policy and any Department/School or professional guidelines in the conduct of your study including relevant guidelines regarding health and safety of researchers and University Health and Safety Policy.

It is also your responsibility to follow University guidance on Data Protection Policy:

- General guidance for all data protection issues
- University Data Protection Policy

You are reminded that as a University of Portsmouth Researcher you are bound by the UKRIO Code of Practice for Research; any breach of this code could lead to action being taken following the University's Procedure for the Investigation of Allegations of Misconduct in Research.

Any changes in the answers to the questions reflecting the design, management or conduct of the research over the course of the project must be notified to the Faculty Ethics Committee. **Any changes that affect the answers given in the questionnaire, not reported to the Faculty Ethics Committee, will invalidate this certificate.**

This ethical review should not be used to infer any comment on the academic merits or methodology of the project. If you have not already done so, you are advised to develop a clear protocol/proposal and ensure that it is independently reviewed by peers or others of appropriate standing. A favourable ethical opinion should not be perceived as permission to proceed with the research; there might be other matters of governance which require further consideration including the agreement of any organisation hosting the research.

#### Governance Checklist

**A1-BriefDescriptionOfProject:** This study proposes to design and evaluate an application, based upon reminiscence therapy, which can act as storage for personal 'positive memories' in a range of media type, including pictures and audio.

**Certificate Code:** D265-BC41-E71B-5943-BB61-F7A1-274B-32A7 Page 1

**A2-Faculty:** Technology  
**A5-AlreadyExternallyReviewed:** Yes  
**A6-ExternalReviewReferenceNumber:** 12/SC/0670  
**A7-NameOfReviewingBody:** South Central - Berkshire NRES Research Ethics Committee  
**B1-HumanParticipants:** Yes  
**B4-InvolvesNHSPatients:** No  
**B5-NoConsentOrDeception:** No  
**B7-InvolvesUninformedOrDependents:** No  
**B9-FinancialInducements:** No  
**C1-DrugsPlacebosOrOtherSubstances:** No  
**C2-BloodOrTissueSamples:** No  
**C3-PainOrMildDiscomfort:** No  
**C4-PsychologicalStressOrAnxiety:** Yes  
**PsychologicalStressOrAnxietyWarning**  
**C5-ProlongedOrRepetitiveTesting:** No  
**C6-SafetyRisksBeyondAssessment:** No  
**D2-PhysicalEcologicalDamage:** No  
**D4-HistoricalOrCulturalDamage:** No  
**E1-ContentiousOrIllegal:** No  
**E2-SociallySensitiveIssues:** No  
**F1-InvolvesAnimals:** No  
**F2-HarmfulToThirdParties:** No  
**G1-ConfirmReadEthicsPolicy:** Confirmed  
**G2-ConfirmReadUKRIOCodeOfPractice:** Confirmed  
**G3-ConfirmReadConcordatToSupportResearchIntegrity:** Confirmed  
**G4-ConfirmedCorrectInformation:** Confirmed

Carl Adams

Check Chair Faculty

Review

13/3/2015

Miss Gurr  
16/3/2015

## A.4 Study 4

### A.4.1 Participant Information Sheets



# Participant Information Sheet

## Evaluating a Technology-Supported Intervention based on Positive Reminiscence Therapy

You have been invited to take part in a research study.

Before you decide, it is important for you to understand why the research is being done and what it will involve.

Please take time to read the information on the following pages carefully.

### What is the purpose of the study?

By the Prime Minister's own admission dementia has become a crisis. As there is currently no cure, we need to think about ways in which to use the current advances in technology in order to alleviate some of the symptoms. Reminiscence therapy (RT) may provide a possible solution. RT involves using objects (such as photos) from one's past to encourage the discussion of memories. It can be argued that RT has a significant positive impact on the happiness of people living with dementia and their carers. RT can also improve communication skills and a person's self-awareness.

With the invention of portable touch screen computers; there is the potential to produce a program which can help with the reminiscence process. A previous study has designed and developed this program. This study aims to assess whether the developed program has a positive effect on feelings of happiness for people living with dementia and their carers.

**Why have I been invited?**

You have been chosen to take part in this study as you are a person living with dementia or a carer.

You will be asked to complete a questionnaire to evaluate your levels of happiness at three points over the course of eight weeks. This will allow for changes in your feelings of happiness to be observed and to investigate whether the program could be responsible for this change.

**Do I have to take part?**

This is a voluntary study and as such, it is up to you whether or not to take part. If you do decide to take part, you will be given this information sheet to keep, together with a copy of the attached consent form. If you decide to take part you are still free to withdraw at any point in time and without providing a reason.

**What will it involve?**

You will be placed in one of the following three groups:

Group 1 If you are placed into this group, you will be asked to complete a questionnaire at three different points over the course of eight weeks.

Group 2 If you are placed into this group, you will be asked to attend weekly group reminiscence sessions lasting one hour over the course of eight weeks. You will also be asked to complete a questionnaire at three different points over the course of eight weeks.

Group 3 If you are placed into this group, you will be asked to take home a portable touch screen computer with the reminiscence program already included. You will be shown how to use the program and encouraged to use it at least once a week over a period of eight weeks. You will be asked to complete a questionnaire at three different points over the course of eight weeks.

**What are the possible disadvantages and risks of taking part?**

Participation in this research may result in distress due to the reliving of personal memories, particularly during the group reminiscence sessions. Every step will be taken to reduce the possibility of this occurring; however, if you become distressed, someone will be able to provide emotional support should you require it.

If you become distressed as a result of participation outside the group reminiscence sessions, we recommend you contact one of the following groups who will be able to put you in touch with an appropriate person to talk to:

Mind Infoline: 0845 766 0163, [info@mind.org.uk](mailto:info@mind.org.uk), [www.mind.org.uk](http://www.mind.org.uk)

Samaritans: 0845 790 9090, [jo@samaritans.org](mailto:jo@samaritans.org), [www.samaritans.org](http://www.samaritans.org)

**What are the possible benefits of taking part?**

It has been suggested that RT could improve your levels of happiness. The aim of this project is to assess whether portable touch screen computers could contribute to this.

**Will I be recorded, and how will the recorded media be used?**

Any reminiscence sessions will not be recorded. However, if you are part of the group using the portable touch screen computers, you will be asked to discuss your opinions of the program. This discussion will be audio-recorded for analysis purposes. No other use will be made of the recording without your written permission, and no one outside the study will be allowed access to the original recordings.

**I'm in group 3, will the portable touch screen computer store any of my personal information?**

You will be asked to include your personal memories in the program. However, when the portable touch screen computer is returned to the researcher, all your memories will be removed from the program.

In addition, the portable touch screen computer will create a log of the interactions you make with the program. The data produced will contain no identifiable information and will not contain any personal details relating to you. Unfortunately, due to the anonymous nature of the data, we will not be able to provide you with a paper copy of this log. However, the log will be created when the portable touch screen computer is returned to the researcher, and you will be able to verify that no personal details are kept.

**What will happen to the results of this research study?**

The results of this research will be included within the supporting documentation for a PhD thesis. The results from this research will be submitted for publication within relevant journals and conference proceedings. We will be more than happy to supply you with a printout of any publications upon request.

**Who is organising and funding the research?**

As part of a PhD project, this research is supported by the University of Portsmouth. The majority of the research is self-funded, however, the portable touch screen computers which will be used, have been funded as part of a University of Portsmouth Higher Education Innovation Funding application.

**Who has reviewed the study?**

This study has been reviewed by the School of Computing Research Ethics Committee at the University of Portsmouth (reference number: )

Thank you for taking the time to read this information sheet.  
Should you have any questions, please do not hesitate to ask us.

For further information, please contact:

Claire Ancient,  
University of Portsmouth,  
School of Computing,  
Buckingham Building,  
Lion Terrace,  
Portsmouth,  
PO1 3HE  
Email: [claire.ancient@port.ac.uk](mailto:claire.ancient@port.ac.uk)  
Telephone: 023 9284 6460

If you have any concerns regarding this research, please contact Claire Ancient in the first instance. If you are not entirely happy with their response, please contact the Chair of the School of Computing Research Ethics Committee in confidence by writing to:

Chair of School of Computing Research Ethics Committee,  
School of Computing,  
University of Portsmouth,  
Buckingham Building,  
Lion Terrace,  
Portsmouth,  
Hampshire,  
PO1 3HE,  
UK.



## A.4.2 Participant Consent Forms

### A.4.2.1 Person Living with Dementia



Study Activity:

### Consent Form

**Title of Project:** Evaluating a Technology-Supported Intervention Based on Positive Reminiscence Therapy

**Name of Researcher:** Claire Ancient

Please Initial  
All Boxes

1. I confirm that I have read and understand the information sheet dated September 2014 (Version 1) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving reason, without my care or legal rights being affected.
3. I agree to take part in the above study
4. I agree to the retention and future use of data in the event of me losing the capacity to consent.
5. I agree to discussions relating to the study being audio recorded.
6. I agree to the use of anonymised quotes in publications.







\_\_\_\_\_  
Name of Participant

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Person Taking Consent

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Consent Form Issue Date:  
Consent Form Version Number: Version 1 September 2014

Page 1 of 1

**A.4.2.2 Carer**

Study Activity:

**Consent Form**

**Title of Project:** Evaluating a Technology-Supported Intervention Based on Positive Reminiscence Therapy

**Name of Researcher:** Claire Ancient

Please Initial  
All Boxes

1. I confirm that I have read and understand the information sheet dated September 2014 (Version 1) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving reason, without my care or legal rights being affected.
3. I agree to take part in the above study
4. I agree to discussions relating to the study being audio recorded.
5. I agree to the use of anonymised quotes in publications.


_____ Name of Participant	_____ Signature	_____ Date
_____ Name of Person Taking Consent	_____ Signature	_____ Date

### A.4.3 School of Computing Referral Certificate



## Certificate of Fast Track Ethics Review

<b>Project Title:</b>	Evaluating a Technology-Supported Intervention Based on Positive Reminiscence Therapy
<b>Student Number:</b>	527922
<b>Application Date:</b>	17/09/2014 16:26:58

You must download your referral certificate, print a copy and keep it as a record of this review.

You should **submit your certificate to your FEC representative for further review.**

The FEC representative for the School of Computing is Carl Adams

It is your responsibility to follow the University Code of Practice on Ethical Standards and any Department/School or professional guidelines in the conduct of your study including relevant guidelines regarding health and safety of researchers including the following:

- University Policy
- Safety on Geological Fieldwork

It is also your responsibility to follow University guidance on Data Protection Policy:

- General guidance for all data protection issues
- University Data Protection Policy

**ProjectTitle:**

Evaluating a Technology-Supported Intervention Based on Positive Reminiscence Therapy

**SchoolOrDepartment:**

SOC

**PrimaryRole:**

PostgraduateStudent

**SupervisorName:**

Dr Alice Good

**HumanParticipants:**

Yes

**HumanParticipantsWarning**

**ParticipantInformationSheets:**

Both participant information sheets and consent forms will be provided. Participants will be given at least a week to consider whether they want to participate in the research. Any questions which do arise will be answered in full.

**Certificate Code:** 6ECD-F182-7EFF-F5C4-F32F-6F54-840E-E4D1      Page 1 / 3

**Participant Confidentiality:**

Participants will be given an identifying number, which the researcher will not be able to link back to the individual participants.

The data gained as part of the well-being questionnaire will be anonymous and as such, the researcher will be unable to identify the participant which has completed the questionnaire. At no point in the questionnaire will the participants be asked to enter any identifying data.

**Involves NHS Patients Or Staff:**

No

**No Consent Or Deception:**

No

**Involves Uninformed Or Dependents:**

No

**Drugs Placebos Or Other Substances:**

No

**Blood Or Tissue Samples:**

No

**Pain Or Mild Discomfort:**

No

**Psychological Stress Or Anxiety:**

Yes

**Psychological Stress Or Anxiety Warning  
Prolonged Or Repetitive Testing:**

No

**Financial Inducements:**

No

**Physical Ecological Damage:**

No

**Historical Or Cultural Damage:**

No

**Harm To Animal:**

No

**Harmful To Third Parties:**

No

**Supervisor Review**

Supervisor signature:

Date:

*[Handwritten signature]*  
*17/9/14*

**Review by FEC Representative**Name of representative: *CARL ADAMS*

Comments:

Representative signature: *Carl Adams*Date: *12/1/2014**All OK.*

## A.5 UPR16 Form

### FORM UPR16

#### Research Ethics Review Checklist



Please include this completed form as an appendix to your thesis (see the Postgraduate Research Student Handbook for more information)

<b>Postgraduate Research Student (PGRS) Information</b>		<b>Student ID:</b>	434446
<b>PGRS Name:</b>	Claire Ancient		
<b>Department:</b>	Computing	<b>First Supervisor:</b>	Dr Alice Good
<b>Start Date:</b> (or progression date for Prof Doc students)	October 2012		
<b>Study Mode and Route:</b>	Part-time <input type="checkbox"/> Full-time <input checked="" type="checkbox"/>	MPhil <input type="checkbox"/> PhD <input checked="" type="checkbox"/>	MD <input type="checkbox"/> Professional Doctorate <input type="checkbox"/>

<b>Title of Thesis:</b>	Delivering Positive Reminiscence Through a Ubiquitous Device Application Designed for People Living with Dementia and Their Care-givers
<b>Thesis Word Count:</b> (excluding ancillary data)	59,682

If you are unsure about any of the following, please contact the local representative on your Faculty Ethics Committee for advice. Please note that it is your responsibility to follow the University's Ethics Policy and any relevant University, academic or professional guidelines in the conduct of your study

Although the Ethics Committee may have given your study a favourable opinion, the final responsibility for the ethical conduct of this work lies with the researcher(s).

#### UKRIO Finished Research Checklist:

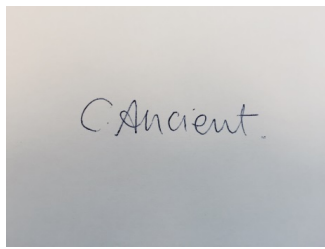
(If you would like to know more about the checklist, please see your Faculty or Departmental Ethics Committee rep or see the online version of the full checklist at: <http://www.ukrio.org/what-we-do/code-of-practice-for-research/>)

a) Have all of your research and findings been reported accurately, honestly and within a reasonable time frame?	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
b) Have all contributions to knowledge been acknowledged?	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
c) Have you complied with all agreements relating to intellectual property, publication and authorship?	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
d) Has your research data been retained in a secure and accessible form and will it remain so for the required duration?	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
e) Does your research comply with all legal, ethical, and contractual requirements?	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>

#### Candidate Statement:

I have considered the ethical dimensions of the above named research project, and have successfully obtained the necessary ethical approval(s)

<b>Ethical review number(s) from Faculty Ethics Committee (or from NRES/SCREC):</b>	449D-201F-3600-550A-0C5F-9403-34A6-A434  C6CE-04BB-EA1C-2230-DA00-CB7C-82C4-56A5  12/SC/0670 D265-BC41-E71B-5943-
---	--

		BB61-F7A1-274B-32A7 6ECD-F182-7EFF-F5C4- F32F-6F54-840E-E4D1
If you have <i>not</i> submitted your work for ethical review, and/or you have answered 'No' to one or more of questions a) to e), please explain below why this is so:		
<div></div>		
<b>Signed (PGRS):</b>		<b>Date:</b> 29/02/2016

## APPENDIX

### B

## THE PERCEPTION OF MEMORIES

### B.1 Questionnaire Development

The initial study aimed to evaluate the everyday memory which needed to be included within the questionnaire. Care-givers of PwDs and members of staff in the School of Computing at the University of Portsmouth were asked to identify five everyday events which made them feel happy and five which made them feel sad. Events which were identified as happy were given a score of 1 and sad recollections were given a -1 score.

Table B.1: Ranked care-giver positive and negative events

Event	Score
Morning Tea	2
Seeing family	2
Pottering in the garden	2
Sunshine / Good Weather	2
Winning a bet	1
Eating chocolate	1
Smell of mown grass	1
Butterflies	1
Snow	1
Partner remembering them	1

continued ...



... continued

Event	Score
Coffee / Cake	1
Watching sports	1
Cooking	1
Seeing new life in the garden	1
Not needing to cook	1
Lie In	1
Going out on their own	1
Queue Jumpers	-1
Partner not disappearing	-1
Partner mistaking them for someone else	-1
Having too much to do	-1
Interruptions	-1
Too much noise	-1
Traffic jams	-1
Partner not getting dressed properly	-1
Wet bed	-1
Washing (more than 1 load)	-2
Bad weather	-2
Cold Calls (PPI)	-2
Being followed about	-2
Not being able to find things in their proper place	-3
Needing to repeat themselves	-3

Table B.2: Ranked School of Computing staff positive and negative events

Event	Score
Events	Score
Hot/Relaxing Bath	4
Listening to music	4
Alcohol! - First glass on Friday	4
Seeing friends / socialising	4
Eating chocolate	3
Getting into bed	3
Listening to garden sounds	2
Playing musical instrument	2
Completing a tricky job	2
Good food	2
Uncontrollable smiles	2
Good Weather	2
Exercise	2

continued ...

... continued

Event	Score
Kindness of Strangers	2
Watching tv	2
Looking at art	1
Research	1
Watching sports	1
Playing sports	1
Walking dog on dry day	1
Clean cotton bedsheets	1
A early convincing team win	1
Riding the last wave of the day	1
Time to do exactly what you want	1
Good news	1
Discovering a new book by favourite author	1
Tea	1
Sex	1
Gratitude	1
Other people's happiness	1
Interacting with Cat	1
Clothes shopping	1
Sense of calm at home	1
Good book	1
Not being at Work	1
Fridays	1
Good view	1
Completing the day's tasks	1
Getting petrol	-1
Bad news	-1
Walking down "mean streets"	-1
Talking to some people	-1
Admin	-1
Getting up early	-1
Reading business emails	-1
Listening to DC	-1
Listening to NF	-1
Walking dog on wet day	-1
Uncooperative colleagues	-1
Traffic jams	-1
Lack of parking	-1
Inequality	-1
Observing pain and not being able to help	-1

continued ...

... continued

Event	Score
Extinction of life on Earth	-1
Lack of time	-1
Completing urgent jobs - not to best ability	-1
Uncontrollable noise	-1
Irritating point of view from public figure	-1
Shouting	-1
Hangovers	-1
Grumbles at work	-1
Poor quality work	-1
Lack of sleep	-1
Being let down by others	-1
Marking	-1
Boredom	-1
Lack of money	-1
Lack of organisation	-1
Electronic things breaking down	-1
Bad food	-1
Pressure at Work	-1
Arguing with Teenage Child	-1
Food Shopping	-1
Wet Towels on floor	-1
Going to work on sunny day	-1
Getting up	-1
deadline submission	-1
Early weekend wake up	-1
Flat tire	-1
Making mistakes	-2
Company policy	-2
Expectation rather than request (expectation of immediate action)	-2
Work	-2
Cleaning	-2
Own lateness	-3
Other people being late	-4
Poor weather (inc being cold)	-4

## B.2 Questionnaire Pilot

### B.2.1 Quantitative Output

Table B.3: Pilot results for stimuli variables

Variable	N	Min	Max	Mean	S.d.
Stimuli - music from early years	11	1.00	5.00	3.2727	1.48936
Stimuli - music from teenage years	11	3.00	5.00	4.2727	0.90453
Stimuli - recent music	11	1.00	5.00	2.9091	1.30035
Stimuli - theme tunes from favourite TV shows	11	1.00	5.00	3.7273	1.10371
Stimuli - favourite music of a family member	10	1.00	5.00	3.3000	1.49443
Stimuli - friend/partner's favourite music	10	1.00	5.00	3.6000	1.50555
Stimuli - photos of self	11	1.00	5.00	3.7273	1.27208
Stimuli - family photos	11	3.00	5.00	4.6364	0.67420
Stimuli - friend photos	11	2.00	5.00	3.8182	0.98165
Stimuli - holiday photos	11	4.00	5.00	4.2727	0.46710
Stimuli - school time photos	10	1.00	5.00	3.6000	1.26491
Stimuli - scenery photos	11	1.00	4.00	2.7273	0.90453
Stimuli - video of self	8	1.00	5.00	3.7500	1.28174
Stimuli - video of family	10	1.00	5.00	4.0000	1.15470
Stimuli - video of friends	9	1.00	4.00	3.4444	1.01379
Stimuli - video of international / national events	11	1.00	4.00	2.9091	0.94388
Stimuli - newspaper clippings of personal events	9	2.00	5.00	3.7778	1.09291
Stimuli - newspaper clippings of local events	9	2.00	5.00	3.4444	0.88192
Stimuli - newspaper clippings of international / national events	10	1.00	4.00	2.7000	1.05935
Stimuli - newspaper clippings of odd / unexpected events	8	1.00	3.00	2.0000	0.75593
Stimuli - stories of funny things that have happened to me	10	4.00	5.00	4.4000	0.51640
Stimuli - stories of personal achievements	11	1.00	5.00	3.7273	1.10371
Stimuli - stories of dramatic events which have happened to me	11	1.00	5.00	3.7273	1.10371
Stimuli - stories of events that I have taken part in	11	1.00	4.00	3.3636	1.12006

Table B.4: Pilot results for stimuli variables - averages

Variable	N	Min	Max	Mean	S.d.
Mean of Music Scores	11	2.17	4.50	3.5242	.64792
Mean of Photo Scores	11	3.17	4.50	3.7939	.46591
Mean of Video Score	11	1.00	4.50	3.5152	.94341
Mean of Newspaper Score	10	2.25	4.00	3.1000	.57975
Mean of Story Score	11	2.00	4.75	3.7879	.69758

Table B.5: Pilot results for big international / national event variables

Variable	N	Min	Max	Mean	S.d.
Big event - James Dean	3	2.00	3.00	2.6667	.57735

continued ...

... continued

Variable	N	Min	Max	Mean	S.d.
Big event - Margaret Thatcher	6	3.00	5.00	3.6667	.81650
Big event - Hindenburg disaster	5	2.00	3.00	2.2000	.44721
Big event - QE2 coronation	5	3.00	5.00	4.2000	.83666
Big event - demolition of Berlin wall	10	3.00	5.00	4.0000	.81650
Big event - Chernobyl	8	1.00	3.00	1.7500	.70711
Big event - Olympics	11	3.00	5.00	4.4545	.68755
Big event - 7/7	10	1.00	2.00	1.2000	.42164
Big event - Harry Potter	7	3.00	4.00	3.2857	.48795
Big event - VE day	4	3.00	5.00	4.0000	1.15470
Big event - Wizard of Oz release	3	3.00	3.00	3.0000	.00000
Big event - Diana	9	1.00	3.00	1.4444	.72648
Big event - Japanese tsunami	9	1.00	3.00	1.4444	.72648
Big event - Battle of Britain	4	1.00	3.00	2.2500	.95743
Big event - Star Wars	4	3.00	3.00	3.0000	.00000
Big event - moonwalk	6	3.00	5.00	4.3333	.81650
Big event - ashes	6	3.00	5.00	4.1667	.75277
Big event - JFK assassination	7	1.00	3.00	1.4286	.78680

Table B.6: Pilot results for big personal events variables

Variable	N	Min	Max	Mean	S.d.
Big personal - wedding anniversary	7	1.00	5.00	4.0000	1.41421
Big personal - 16th	8	3.00	5.00	3.5000	.75593
Big personal - 1st day at primary	9	1.00	5.00	3.5556	1.13039
Big personal - break up	5	1.00	3.00	2.2000	.83666
Big personal - last hospital admission	7	2.00	4.00	2.8571	.69007
Big personal - last house move	11	2.00	5.00	3.3636	.92442
Big personal - first loved one death	9	1.00	2.00	1.1111	.33333
Big personal - 21st	10	1.00	5.00	3.6000	1.26491
Big personal - 1st date	8	3.00	5.00	4.1250	.64087
Big personal - first home away from parents	8	2.00	4.00	3.2500	.88641
Big personal - uni graduation	8	3.00	5.00	4.3750	.91613
Big personal - birth of first child	8	5.00	5.00	5.0000	.00000
Big personal - last day at secondary school	10	2.00	5.00	3.3000	.82327
Big personal - buying first home	8	3.00	5.00	4.6250	.74402

Table B.7: Pilot results for everyday event variables

Variable	N	Min	Max	Mean	S.d.
Everyday - favourite music	11	2.00	5.00	4.0000	.77460

continued ...

... continued

Variable	N	Min	Max	Mean	S.d.
Everyday - cold calls	9	1.00	3.00	2.1111	.92796
Everyday - relaxing bath	9	4.00	5.00	4.2222	.44096
Everyday - being in the garden	10	3.00	5.00	4.2000	.63246
Everyday - not being able to find something	10	1.00	3.00	1.9000	.73786
Everyday - visits from friends/family	10	3.00	5.00	4.3000	.67495
Everyday - lateness	10	1.00	3.00	1.4000	.69921
Everyday - sunny day	10	3.00	5.00	4.5000	.70711
Everyday - eating chocolate	10	3.00	5.00	4.0000	.94281
Everyday - going to work	8	3.00	5.00	4.0000	.92582
Everyday - repeating the same conversation	10	1.00	3.00	2.5000	.70711
Everyday - first tea / coffee	9	3.00	5.00	4.1111	.78174
Everyday - household chores	8	1.00	3.00	2.1250	.83452
Everyday - first drink on Friday night	4	3.00	5.00	4.0000	.81650

Table B.8: Pilot results for memory type averages

Variable	N	Min	Max	Mean	S.d.
Mean of International / National Events	11	2.20	3.22	2.8150	.30252
Mean of Big Personal Events	11	2.50	4.10	3.4327	.51497
Mean of Everyday Events	11	2.00	3.79	3.2361	.52049

## B.2.2 Qualitative Output

### Question 7 - Other Stimuli

- People's names from the past (e.g. School friends / old work colleagues etc)
- Meeting someone from the distant past who I had not met for very many years
- Smell (x2)
- Particular Foods

### Question 9a - Other Happy International / National Events

- England FC winning world cup
- Achievement of sport related events
- Marriage of Kate and William

### Question 9b - Other Sad International / National Events

- Black Monday

- Queen Mother's Death
- 9/11 attacks in New York (x2)
- Aberfan Disaster (1966)
- Natural disasters
- England World Cup / Euro exits (though only briefly) (x2)

#### Question 13a - Other Happy Personal Events

- Wedding / Engagement

#### Question 13b - Other Sad Personal Events

- Death of a Pet

#### Question 15a - Other Happy Everyday Events

- Playing with a pet
- Mealtimes
- Being in church especially playing the organ and taking part
- Watching granddaughter develop and grow

#### Question 15b - Other Sad Everyday Events

- Sad books
- Getting up in the morning
- Uncertainties about growing old
- Missed appointments (longer explanation in questionnaire)

#### Question 16 - Other Comments

- Provokes many different emotions
- Certain scenery (e.g. bluebell woods)

### **B.2.2.1 Discussion**

In total, eleven people participated in this part of the research study. Of those 11 people, six were female and 5 were male. The mean age for the participants was 46.55 ( $SD = 19.40$ ), with a range between 22 and 79. In addition, 3 participants reported they had been diagnosed with mental health conditions, all of whom stated they had received a diagnosis for stress.

When completing the demographic information, some of the participants struggled with their current location. There was some debate whether Southampton and Winchester are classed as South East England or South West England, in the end deciding it was in the South West. This raised the further discussion about how to present the question in order to avoid this conflict. It was discussed whether to simply ask the participants to state their local city and country, with the researcher deciding which region each location belonged to. However, this would make the data cleaning extremely time consuming. In the end, it was decided to leave the questions as they are, in the hope that if the participants are unsure, they complete the box which allows them to state their location.

The results from the pilot study suggest the most effective type of memory prompt is photographs ( $N = 11$ ,  $M = 3.79$ ,  $SD = 0.47$ ); whereas the least effective is newspaper clippings ( $N = 10$ ,  $M = 3.10$ ,  $SD = 0.58$ ). This agrees with the results of the individual stimuli which suggests the best prompt is photographs of a person's family ( $N = 11$ ,  $M = 4.64$ ,  $SD = 0.67$ ). In addition, the least effective memory prompt is newspaper clippings of odd or unexpected events ( $N = 8$ ,  $M = 2.00$ ,  $SD = 0.76$ ). From earlier work, it was anticipated that music would be an extremely effective memory prompt. However, the data seems to show that stories ( $N = 11$ ,  $M = 3.79$ ,  $SD = 0.70$ ) are more effective at evoking memories than music ( $N = 11$ ,  $M = 3.52$ ,  $SD = 0.65$ ). These results need to be approached cautiously, as the margins between the various groups are very small. A larger sample size should lead to more accurate results, with greater differentiations between the categories.

In addition to those listed, participants suggested smells, particular foods, meeting past acquaintances and names of people previously known as stimuli which evoke memories. The suggestion of smell is an interesting one. Whilst smell can be a very evocative prompt for memories, the aim of this study is to assess the types of stimuli to be used in ubiquitous device, of which smell currently is impossible to replicate. This has led to this type of stimulus being left out of this questionnaire.

When comparing the events which can evoke memories (international / national, personal and everyday), the international events tend to evoke memories which are slightly sad ( $N = 11$ ,  $M = 2.81$ ,  $SD = 0.30$ ) and personal events seem to generate happier ones ( $N = 11$ ,  $M = 3.43$ ,  $SD = 0.51$ ).

When comparing the individual international / national events, the Olympics in 2012 seems to make people feel happiest ( $N = 11$ ,  $M = 4.45$ ,  $SD = 0.69$ ) whereas the 7/7 London bombings in 2007 evokes very sad memories ( $N = 10$ ,  $M = 1.20$ ,  $SD = 0.42$ ). It seems that there are two events which should be changed, as they do not evoke any feelings of either happiness or sadness. These are the release of Wizard of Oz ( $N = 3$ ,  $M = 3.00$ ,  $SD = 0.00$ ), which has been substituted with Fred Perry winning Wimbledon and the release of Star Wars ( $N = 4$ ,  $M = 3.00$ ,  $SD = 0.00$ ), which has been changed to the end of the Vietnam War. Furthermore, the release of the first Harry Potter book ( $N = 7$ ,  $M = 3.28$ ,  $SD = 0.49$ ), seems to be part of the same type of event (i.e. release of an important piece of fiction) and therefore has been replaced with the release of Nelson Mandela from prison. It is hoped



that these three event changes will evoke stronger feelings.

The notion that international / national events evoke sadder memories than the other two groups of events is evident in the questions asking for additional suggestions. The participants seem to have found it easier to propose events which make them sad rather than ones which evoke feelings of happiness.

Additionally, it was suggested that the descriptions of the international / national events also include the year in which they occurred. This will allow the participants to place the event within a specific period of time, which could allow them to answer the question easier and more accurately.

Question 10 suggested that the happiest memory is the birth of a child, whilst the saddest one is the death of a loved one. This was confirmed within question 12, which showed the mean of the birth of the first child as 5.00 ( $N = 8$ ,  $SD = 0.00$ ) and the death of a loved one getting the lowest mean of 1.11 ( $N = 9$ ,  $SD = 0.33$ ). When coding the five memories into various groups, it became clear that there were 4 broad categories, family, academia, childhood and social. Whilst childhood evoked the happiest memories ( $M=3.60$ ), academia was not far behind with a mean of 3.43,. However, this result could simply be due to the people included within the survey, the majority of whom are currently studying / working at a university or have just completed their studies. The group which included the saddest memories was family. However, this is due to the majority of people listing death of family members, which has negated the people listing birth of children as a happy memory.

When it came to the personal memories, it was suggested that question 13 was merely a duplicate of question 11. Therefore, it was decided to remove this question, in order to avoid collecting the same data twice and to reduce the amount of time spent completing the questionnaire. In addition, one participant commented that they struggled to think of five happy memories and five sad ones. Whilst other participants did elect to miss the part of or the entire question if they could not complete it, the decision was made to make it explicit that the whole question is not compulsory.

The pilot study has shown that the scale for the everyday events was incorrect, with many people commenting that many emotions are evoked by the options included as part of question 14. There were two suggestions made for how to combat this problem. Firstly, there could be an additional box which allows the participant to include the other emotions they felt about the event (such as “angry” or “annoyed” for the cold callers option). Alternatively, the scale could be changed to represent positive or negative instead of happy and sad. This would bring the questionnaire in line with the initial work carried out to assess the options for question 14. It was chosen to change both question 14 and 15 to represent positive and negative emotions rather than happy and sad.

Despite this problem, most people did answer question 14. This showed that lateness is more likely to make people feel sad ( $N = 10$ ,  $M = 1.4$ ,  $SD = 0.70$ ) with a sunny day making people feel happy ( $N = 10$ ,  $M = 4.5$ ,  $SD = 0.71$ ). However, it is important to note that this pilot study was carried out at

the beginning of a long stretch of sunny weather, which could have had an effect on the outcome of these results. It would be interesting to see whether asking the same question in the middle of winter would have the same effect.

One surprising result is the going to work option. Earlier work has suggested that this makes people feel negative, however, in this study it would appear to make people feel happy ( $N = 8$ ,  $M = 4.00$ ,  $SD = 0.93$ ). This is definitely an interesting result, which will be considered further as part of the questionnaire when the final results are analysed.

It is important to emphasise that this is only a pilot study with a small sample of the intended population and therefore, does not provide definitive conclusions. In order to be more confident in the findings, a larger sample size is required. However, this exercise has allowed the questionnaire to be modified in order to eliminate some of the issues raised. The next stage is to ensure ethical approval is granted and releasing the questionnaire to the general public, with the aim of gaining a much larger number of participants.

## B.3 Final Questionnaire



School of Computing  
University of Portsmouth  
Buckingham Building Lion  
Terrace  
Portsmouth PO1 3HE  
United Kingdom

T: +44 (0)23 9284 6363 F:  
+44 (0)23 9284 6364

### Questionnaire

**Study Title:** The Perception of Memories

**Name of Researcher:** Claire Ancient

**Name of Supervisor:** Dr. Alice Good

**Contact Details:**

Address: School of Computing  
University of Portsmouth  
Buckingham Building  
Lion Terrace  
Portsmouth  
Hampshire  
PO1 3HE  
UK  
Telephone: 023 9284 6460  
Email: claire.ancient@port.ac.uk

**Invitation:**

Thank you for reading this. We would like to invite you to take part in our research study by completing this questionnaire. Your responses will be valued and your participation voluntary.

This questionnaire forms part of a computing PhD investigating the effectiveness of an application designed to facilitate reminiscence. The study aims to understand the types of memory which generate feelings of happiness or sadness. By identifying these types of memory, the application can be constructed to focus on promoting positive memories, whilst avoiding negative ones.

We will not ask your name or any identifying details. The questionnaire will be completed anonymously and all reasonable steps will be taken to ensure confidentiality. Responses from completed questionnaires will be collated for analysis. Once this is complete the original answers will be retained until successful completion of the PhD and may be used as part of future research. Up to this stage, completed questionnaires will be stored in a locked cabinet.

You are free to withdraw your participation at any point during the completion of this questionnaire and the results discarded. Should you later reconsider, or wish to withdraw your participation in this research after completion, please contact the researcher up to a week after completing the questionnaire.

All responses will remain confidential

**Questionnaire:**

1. What is your gender?

☐

Male

☐

Female

2. How old are you?

years

3. Which option best describes the geographical location where you were born?  
(Tick one box only)

☐

London

☐

South East  
England

☐

South West  
England

☐

North East  
England

☐

North West  
England

☐

Wales

☐

Scotland

☐

Northern Ireland

☐

Republic of Ireland

☐

Europe

☐

America

☐

Rest of World

If you are unsure, please state the nearest city  
and the country:

4. Which option best describes your current geographical location?  
(Tick one box only)

☐

London

☐

South East  
England

☐

South West  
England

☐

North East  
England

☐

North West  
England

☐

Wales

☐

Scotland

☐

Northern Ireland

☐

Republic of Ireland

☐

Europe

☐

America

☐

Rest of World

If you are unsure, please state the nearest city  
and the country:

All responses will remain confidential

5. Have you ever been diagnosed with a mental health condition?

☐

Yes

☐

No

If yes, please indicate the relevant conditions:

☐

Mild Cognitive Impairment (MCI)

☐

Dementia

☐

Anxiety

☐

Stress

☐

Depression

☐

Borderline Personality Disorder

☐

Bi-polar Disorder

☐

Post Natal Depression

☐

Seasonal Affective Disorder (SAD)

☐

Myalgic Encephalomyelitis (ME) / Chronic Fatigue Syndrome (CFS)

☐

Post Traumatic Stress Disorder

☐

Obsessive Compulsive Disorder

☐

Phobias, please state:

☐

Other, please state:

6. How effective in evoking memories are the following stimuli?  
(For each stimulus, tick one box only)

	Not Effective				Very Effective	This Doesn't Apply to Me
	1	2	3	4	5	
Music from my early years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Music from my teenage years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Music I have been listening to recently	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Theme tunes from my favourite TV shows	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The favourite music of a family member	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My friend or partner's favourite music	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

All responses will remain confidential

6. How effective in evoking memories are the following stimuli? (continued)  
(For each stimulus, tick one box only)

	Not Effective				Very Effective		This Doesn't Apply to Me
	1	2	3	4	5		
Photos of myself	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Photos of my family	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Photos of my friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Photos from holidays	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Photos from my time at school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Photos of scenery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Video footage of myself	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Video footage of my family	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Video footage of my friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Video footage of international/national events	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Newspaper clippings of events which relate to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Newspaper clippings of local events	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Newspaper clippings of international/national events	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Newspaper clippings of odd/unexpected events	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stories of funny things which have happened to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stories of my personal achievements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stories of dramatic events which have happened to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stories of events that I have taken part in	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

All responses will remain confidential

7. Do you have any suggestions, other than those listed above, of stimuli which are effective in evoking memories for you?

8. If you think about each of the following national / international events, how does it make you feel?  
(For each event, tick one box only)

	Very Sad	Sad	Neither Happy or Sad	Happy	Very Happy	Don't Remember the Event
Death of James Dean (1955)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Election of Margaret Thatcher as Prime Minister (1979)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hindenburg disaster (1937)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coronation of Queen Elizabeth II (1953)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Demolition of the Berlin Wall (1989)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chernobyl disaster (1986)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
London Olympics (2012)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7/7 terrorist attacks in London (2005)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The release of Nelson Mandela from prison (1990)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
VE Day (1945)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fred Perry winning Wimbledon (1934)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Death of Princess Diana (1997)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Japanese tsunami (2011)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

All responses will remain confidential

8. If you think about each of the following national / international events, how does it make you feel? (continued)  
(For each event, tick one box only)

	Very Sad	Sad	Neither Happy or Sad	Happy	Very Happy	Don't Remember the Event
Battle of Britain (1940)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The end of the Vietnam War (1975)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neil Armstrong's moonwalk (1969)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
England winning the Ashes (2005)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Assassination of President J.F. Kennedy (1963)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. Do you have any suggestions of significant national / international events, other than those listed above, which if thought about make you feel:

Happy?

Sad?



All responses will remain confidential

10. List up to 5 memories from your life which if thought about make you feel happy.

1.	
2.	
3.	
4.	
5.	

11. List up to 5 memories from your life which if thought about make you feel sad.

1.	
2.	
3.	
4.	
5.	

12. If you think about each of the following personal events, how does it make you feel?  
(For each event tick one box only)

	Very Sad	Sad	Neither Happy or Sad	Happy	Very Happy	Not Applicable / I Don't Remember the Event
My last wedding anniversary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My 16 <sup>th</sup> birthday	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My 1 <sup>st</sup> day at primary school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My first break up with a boyfriend / girlfriend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

All responses will remain confidential

12. If you think about each of the following personal events, how does it make you feel?  
(continued)  
(For each event tick one box only)

	Very Sad	Sad	Neither Happy or Sad	Happy	Very Happy	Not Applicable / I Don't Remember the Event
My last admission to hospital	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The last time I moved house	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The first time a loved one passed away	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My 21 <sup>st</sup> birthday	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The 1 <sup>st</sup> date with my current partner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The first time I moved out of my parents home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My first university graduation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Birth of my first child	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My last day at secondary school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Buying my first house	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13. If you think about each of the following regular everyday events, how does it make you feel?  
(For each event tick one box only)

	Very Negative	Negative	Neutral	Positive	Very Positive	Not applicable
Listening to my favourite music	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Receiving cold calls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A relaxing bath	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Being in the garden	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

All responses will remain confidential

13. If you think about each of the following regular everyday events, how does it make you feel?

(For each event tick one box only)

	Very Negative	Negative	Neutral	Positive	Very Positive	Not applicable
Not being able to find something	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Visiting or being visited by friends / family	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lateness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A sunny day	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eating chocolate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Going to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Repeating the same conversation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
First cup of tea / coffee of the day	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Doing household chores	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
First drink on a Friday night	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

14. Do you have any suggestions of regular everyday events, other than those listed above, which if remembered make you feel:

Positive?

Negative?

All responses will remain confidential

15. Do you have any other comments you would like to make about the effect that memories have on your feelings of happiness or sadness?

Thank you for completing this questionnaire, your contribution is appreciated. Please return the questionnaire to Claire Ancient, using the address provided on the front page.

If you became distressed as a result of taking part in this questionnaire we recommend you contact one of the following groups who will be able to put you in touch with an appropriate person to talk to:

Mind Infoline: 0845 766 0163, [info@mind.org.uk](mailto:info@mind.org.uk), [www.mind.org.uk](http://www.mind.org.uk)

Samaritans: 0845 790 9090 (in the UK), 1850 60 90 90 (in the Republic of Ireland), <http://www.samaritans.org/>

If you have any concerns regarding this research, please contact Claire Ancient or Alice Good in the first instance. If you are not entirely happy with their response, please contact the Chair of the School of Computing Research Ethics Committee in confidence by writing to:

Chair of School of Computing Research Ethics Committee,  
School of Computing,  
Buckingham Building,  
Lion Terrace,  
Portsmouth,  
Hampshire,  
PO1 3HE,  
UK.

## B.4 Questionnaire Rationale

**Question 1** What is your gender?

Input Type Boolean choice

Options Male; Female

Rationale The inclusion of this question will allow the responses from each gender to be isolated, and therefore allow comparisons between these two groups to be drawn.

---

**Question 2** How old are you?

Input Type Numerical input

Options N/A

Rationale Including this question will allow the differences between the various age groups to be analysed. By obtaining the person's age, this variable will be in a linear scale, which will allow for a mean age to be calculated (as required by many journals).

---

**Question 3** Which option best describes the geographical location where you were born?

**Question 4** Which option best describes your current geographical location?

Input Type Tick one box

Unsure option

Options London; South East England; South West England; North East England; North West England; Wales; Scotland; Northern Ireland; Republic of Ireland; Europe; America; Rest of World

Rationale These questions will allow testing of the hypothesis that people living or born in a certain region will have stronger feelings about events in that area. The inclusion of the rest of the world option ensures that these questions are exhaustive. It is anticipated that the majority of respondents will be based in the UK, for this reason the UK has been split into various regions. With the exception of the Japanese Tsunami, all the significant events are based in the UK, Europe or America; for this reason, an option to isolate the European and American respondents from the rest of the world has been included. For some UK locations it may be difficult for respondents to decide which box to tick (for example, Southampton could be located in South East England or South West England). In order to combat this difficulty, an option to include the nearest City has been included, allowing the researcher to include the data in the relevant section.

---

**Question 5** Have you ever been diagnosed with a mental health condition?

Input Type Boolean choice

Choose multiple depending on boolean answer

Option to state specific phobia

Other option

Options Yes; No

Mild Cognitive Impairment; Dementia; Anxiety; Stress; Depression; Borderline Personality Disorder; Bi-polar Disorder; Post Natal Depression; Seasonal Affective Disorder; Myalgic Encephalomyelitis / Chronic Fatigue Syndrome; Post Traumatic Stress Disorder; Obsessive Compulsive Disorder; Phobias

Rationale Establishing the mental health diagnoses of respondents, analysis can occur which shows the effect of different memories on people with a variety of conditions. Mild Cognitive Impairment and Dementia are key conditions for this research project. However, the additional conditions include depressive conditions, which reminiscence therapy has the potential to assist. By including these conditions, analysis can occur in order to aid future research in the possible diversification of the application for use with alternative user groups. The inclusion of the area in which respondents can enter mental health conditions which are not covered ensures that the question is exhaustive.

**Question 6** How effective at evoking memories are the following stimuli?

Sub-questions Music from my early years; Music from my teenage years; Recent music; Theme tunes from my favourite TV shows; The favourite music of a family member; My friend or partner's favourite music; Photos of myself; Photos of my family; Photos of my friends; Photos from past holidays; Photos from my time at school; Photos of scenery; Video footage of myself; Video footage of my family; Video footage of my friends; Video footage of international / national events; Newspaper clippings of personal events; Newspaper clippings of local events; Newspaper clippings of odd / unexpected events; Stories of funny things which have happened to me; Stories of my personal achievements; Stories of dramatic events which have happened to me; Stories of events that I have taken part in

**Question 7** Do you have any suggestions, other than those listed above, of stimuli which are effective at evoking memories?

Input Type Likert scale - tick one box for each stimuli

Options 1 (Not Effective) - 5 (Very Effective); This Doesn't Apply to Me

Text entry box

Rationale The inclusion of these questions will allow the application to be biased towards stimuli which are the most effective at evoking memories. Whilst question 6 is not exhaustive, the respondents are invited to add additional stimuli which evoke memories. This ensures that the question will avoid missing stimuli which are important in prompting memories.

<b>Question 8</b>	When you remember each of the following national / international events, how does it make you feel?
Sub-questions	Death of James Dean (1955); Election of Margaret Thatcher as Prime Minister (1979); Hindenburg disaster (1937); Coronation of Queen Elizabeth II (1953); Demolition of the Berlin Wall (1989); Chernobyl disaster (1986); London Olympics (2013); 7/7 terrorist attacks in London (2005); The release of Nelson Mandela from Prison (1990); VE Day (1945); Fred Perry winning Wimbledon (1934); Death of Princess Diana (1997); Japanese tsunami (2011); Battle of Britain (1940); The end of the Vietnam War (1975); Neil Armstrong's moonwalk (1969); England winning the Ashes (2005); Assassination of President J. F. Kennedy (1963)
<b>Question 9</b>	Do you have any suggestions of significant national / international events, other than those listed above, which when remembered make you feel:
Sub-questions	Happy?; Sad?
Input Type	Likert scale - tick one box for each event Text entry box
Options	Very Sad; Sad; Neither Happy or Sad; Happy; Very Happy; Don't Remember the Event
Rationale	These questions relate to "significant event" memories. The inclusion of these types of memory will allow for observation of the effects that large collective memories for people with mental health conditions. It will also allow analysis of the effect of the event on the mood of various different age groups. The events have been chosen to ensure a balance between events which would appear to evoke feelings of happiness with those would produce sad memories (9 positive and 9 negative). In addition to this, each decade between 1930s and 2010s have 2 events, 1 with positive connotations and 1 associated with negative feelings. Question 9 allows the respondent to add any extra significant events which make them feel both happy and sad. This question will be particularly important during the pilot study phase, as it will ensure that the main events have been covered within the likert scale questions.

---

**Question 10** List 5 memories from your life which when remembered make you feel happy.

**Question 11** List 5 memories from your life which when remembered make you feel sad.

Input Type Text entry boxes

Options N/A

Rationale These questions are designed to evaluate the memories for a person's life which make them feel both happy and sad. They will aim to elicit answers which are not based on the societal customs for happy and sad events (or rites of passage). Questions 12 and 13 have been included to ensure that a comparison between the various types of memory can be drawn. Whilst these questions are designed to include rites of passage which society dictate should evoke happy / sad memories, questions 10 and 11 will be able to find the personal events which can occur but are personal to the individual.

---

<b>Question 12</b>	When you remember each of the following personal events, how does it make you feel?
Sub-questions	My last wedding day; My 16th birthday; My 1st day at primary school; My first break up with a boyfriend / girlfriend; My last admission to hospital; The last time I moved house; The first time a loved one passed away; My 21st birthday; The first date with my current partner; The first time I moved out of my Parents home; My first university graduation; Birth of my first child; My last day at secondary school; Buying my first house
<b>Question 13</b>	Do you have any suggestions of personal significant events, other than those listed above, which when remembered make you feel:
Sub-questions	Happy?; Sad?
Input Type	Likert scale - tick one box for each event Text entry boxes
Options	Very Sad; Sad; Neither Happy or Sad; Happy; Very Happy; This Doesn't Apply to Me
Rationale	<p>These questions are designed to assess the feelings evoked by significant events which are personal to the respondent. This will also allow for the evaluation of how personal events are interpreted by people with various mental health problems compared to people without these conditions.</p> <p>Once again, these events have been chosen to ensure that there is a balance between the events which are associated with happy emotions and feelings of sadness (7 happy and 7 sad events).</p> <p>The inclusion of Question 13 allows the respondent to add any extra personal events which make them feel both happy and sad. This question will be particularly important during the pilot study phase, as it will ensure that the main events have been covered within the likert scale questions.</p>



- Question 14** When you think about each of the following everyday events, how does it make you feel?
- Sub-questions Listening to my favourite music; Receiving cold calls; A relaxing bath; Being in the garden; Not being able to find something; Visiting or being visited by friends / family; Lateness; A sunny day; Eating chocolate; Going to work; Repeating the same conversation; First cup of tea / coffee of the day; Doing household chores; First drink on a Friday night
- Question 15** Do you have any suggestions of everyday events, other than those listed above, which when remembered make you feel:
- Sub-questions Happy?; Sad?
- Input Type Likert scale - tick one for each event  
Text entry boxes
- Options Very Negative; Negative; Neutral; Positive; Very Positive; Not applicable
- Rationale These questions are designed in order to investigate the effect of everyday events on the happiness of the respondents. It will allow for comparisons to be drawn between people who have mental health conditions and those who don't. Once again, these events have been chosen to ensure that there is a balance between the events which are associated with happy emotions and feelings of sadness (7 happy and 7 sad events). Question 13 allows the respondent to add any extra everyday events which make them feel both happy and sad. This question will be particularly important during the pilot study phase, as it will ensure that the main events have been covered within the likert scale questions.

- Question 16** Do you have any other comments you would like to make about the effect that memories have on your levels of happiness?
- Input Type Text entry box
- Options N/A
- Rationale

## B.5 Distribution Testing Results

Table B.10: Shapiro-Wilk Test Results for Music Stimuli Variables

Variable	Shapiro-Wilk Significance Level	Reject Null Hypothesis
Music from Early Years	<0.000	Yes
Music from Teenage Years	<0.000	Yes
Recent Music	<0.000	Yes

Theme Tunes	<0.000	Yes
Family Member Music	<0.000	Yes
Partner or Friend Music	<0.000	Yes
Average Value for Music Stimuli	0.052	No

Table B.11: Shapiro-Wilk Test Results for Photo Stimuli Variables

<b>Variable</b>	<b>Shapiro-Wilk Significance Level</b>	<b>Reject Null Hypothesis</b>
Photos of Myself	<0.000	Yes
Photos of Family	<0.000	Yes
Photos of Friends	<0.000	Yes
Holiday Photos	<0.000	Yes
School Photos	<0.000	Yes
Scenery Photos	0.001	Yes
Average Value for Photo Stimuli	0.055	No

Table B.12: Shapiro-Wilk Test Results for Video Stimuli Variables

<b>Variable</b>	<b>Shapiro-Wilk Significance Level</b>	<b>Reject Null Hypothesis</b>
Videos of Myself	<0.000	Yes
Videos of Family	<0.000	Yes
Videos of Friends	0.001	Yes
Video Footage of International or National Events	0.009	Yes
Average Value for Video Stimuli	0.001	Yes

Table B.13: Shapiro-Wilk Test Results for Newspaper Stimuli Variables

<b>Variable</b>	<b>Shapiro-Wilk Significance Level</b>	<b>Reject Null Hypothesis</b>
Newspaper Clippings Related to Me	<0.000	Yes
Newspaper Clippings of Local Events	0.003	Yes
Newspaper Clippings of International or National Events	0.001	Yes
Newspaper Clippings of Odd / Unexpected Events	<0.000	Yes
Average Value for Newspaper Stimuli	0.269	No

Table B.14: Shapiro-Wilk Test Results for Story Stimuli Variables

<b>Variable</b>	<b>Shapiro-Wilk Significance Level</b>	<b>Reject Null Hypothesis</b>
Stories of Funny Things	<0.000	Yes
Stories of Personal Achievements	<0.000	Yes
Stories of Dramatic Events	<0.000	Yes
Stories of Events I Have Taken Part In	<0.000	Yes
Average Value for Story Stimuli	0.004	Yes

Table B.15: Shapiro-Wilk Test Results for International and National Event Variables

<b>Variable</b>	<b>Shapiro-Wilk Significance Level</b>	<b>Reject Null Hypothesis</b>
Death of James Dean	<0.000	Yes
Margaret Thatcher	<0.000	Yes
Hindenburg Disaster	<0.000	Yes
Coronation of Queen Elizabeth II	0.024	Yes
Demolition of the Berlin Wall	0.037	Yes
Chernobyl Disaster	0.055	No
London Olympics	0.049	Yes
7/7 London Terrorist Attacks	0.001	Yes
Release of Nelson Mandela	0.025	Yes
VE Day	<0.000	Yes
Fred Perry Winning Wimbledon	<0.000	Yes
Death of Princess Diana	0.012	Yes
Tsunami	0.024	Yes
Battle of Britain	<0.000	Yes
Vietnam War	<0.000	Yes
Neil Armstrong Walking on the Moon	0.024	Yes
England Winning the Ashes	<0.000	Yes
Assassination of JFK	0.028	Yes
Average of International and National Events	0.021	Yes

Table B.16: Shapiro-Wilk Test Results for Personal Event Variables

<b>Variable</b>	<b>Shapiro-Wilk Significance</b>	<b>Reject Null</b>
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	<b>Level</b>	<b>Hypothesis</b>
Last Wedding Anniversary	0.018	Yes
16th Birthday	0.324	No
1st Day Primary School	0.324	No
First Break Up	0.093	No
Hospital Admission	<0.000	Yes
Last House Move	0.522	No
First Time a Loved One Passed Away	<0.000	Yes
21st Birthday	<0.000	Yes
1st Date with Current Partner	0.018	Yes
1st Time Moving Out of Parents House	<0.000	Yes
University Graduation	0.002	Yes
Birth of First Child	<0.000	Yes
Last Day of Secondary School	0.197	No
Buying First House	0.018	Yes
Average of Personal Events	0.455	No

Table B.17: Shapiro-Wilk Test Results for Everyday Event Variables

<b>Variable</b>	<b>Shapiro-Wilk Significance Level</b>	<b>Reject Null Hypothesis</b>
Listening to Music	<0.000	Yes
Receiving Cold Calls	<0.000	Yes
Bath	0.002	Yes
Gardening	<0.000	Yes
Unable to Find Something	<0.000	Yes
Visits from Family and Friends	<0.000	Yes
Lateness	<0.000	Yes
Sunny Days	<0.000	Yes
Eating Chocolate	<0.000	Yes
Going to Work	0.002	Yes
Repeating the Same Conversation	0.001	Yes
First Cup of Tea or Coffee of the Day	0.001	Yes
Household Chores	0.001	Yes
First Drink on a Friday Night	<0.000	Yes
Average of Everyday Events	0.010	Yes

## APPENDIX

### C

# DESIGNING DEMENTIA FRIENDLY INTERFACES

## **C.1 Systematic Search Results**

This appendix contains the results of all the searches conducted as part of the systematic literature review.

Table C.1: Systematic review search results

Search Number	Boolean Search Terms	Total Number of Results	Number of Useful Articles
1	dementia AND interact* AND technolog*	71	3
2	dementia AND interact* AND comput*	78	5
3	dementia AND experience AND comput*	44	2
4	dementia AND experience AND technolog*	71	5
5	dementia AND accessib* AND comput*	21	3
6	dementia AND accessib* AND technolog*	24	6
7	dementia AND usab* AND comput*	17	3
8	dementia AND usab* AND technolog*	19	0
9	dementia AND “design considerations”	4	0
10	dementia AND impair* AND technolog*	189	5
11	dementia AND impair* AND comput*	451	8
12	dementia AND mobile	96	4
13	dementia AND (“human factor” OR “human factors”)	12	0
14	dementia AND hci	6	1
15	dementia AND “interface design”	1	1
16	dementia AND tablet AND comput*	4	1
17	dementia AND tablet AND technolo*	4	1
18	dementia AND iPad	6	0

continued . . .

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Search Number	Boolean Search Terms	Total Number of Results	Number of Useful Articles
19	dementia AND ubiquitous AND comput*	5	0
20	dementia AND ubiquitous AND technolog*	3	1
21	dementia AND pervasive AND comput*	9	3
22	dementia AND pervasive AND technolog*	5	3
23	dementia AND interface AND comput*	64	9
24	dementia AND interface AND technolog*	20	5
25	old* AND interact* AND technolog*	874	41
26	old* AND interact* AND comput*	934	43
27	old* AND "user experience"	20	1
28	old* AND experience AND comput*	947	29
29	old* AND experience AND technolog*	1044	26
30	old* AND accessib* AND comput*	191	14
31	old* AND accessib* AND technolog*	219	10
32	old* AND usab* AND comput*	135	25
33	old* AND usab* AND technolog*	147	22
34	old* AND ("design considerations" OR "design consideration")	27	0
35	old* AND ("design implications" OR "design implication")	13	2
36	old* AND impair* AND technolog*	371	13
37	old* AND impair* AND comput*	1131	10

continued ...

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Search Number	Boolean Search Terms	Total Number of Results	Number of Useful Articles
38	old* AND mobile		0
39	old* AND ("human factor" OR "human factors")	151	10
40	old* AND hci	48	3
41	old* AND "interface design"	55	14
42	old* AND tablet AND comput*	73	3
43	old* AND tablet AND technolo*	40	2
44	old* AND iPad	33	0
45	old* AND ubiquitous AND comput*	70	1
46	old* AND ubiquitous AND technolog*	82	0
47	old* AND pervasive AND comput*	31	0
48	old* AND pervasive AND technolog*	54	0
49	old* AND interface AND comput*	339	45
50	old* AND interface AND technolog*	217	25
51	elder* AND interact* AND technolog*	269	23
52	elder* AND interact* AND comput*	221	22
53	elder* AND "user experience"	19	5
54	elder* AND experience AND comput*	140	12
55	elder* AND experience AND technolog*	212	14
56	elder* AND accessib* AND comput*	44	7

continued ...



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Search Number	Boolean Search Terms	Total Number of Results	Number of Useful Articles
57	elder* AND accessib* AND technolog*	76	8
58	elder* AND usab* AND comput*	44	15
59	elder* AND usab* AND technolog*	84	10
60	elder* AND ("design consideration" OR "design considerations")	9	1
61	elder* AND ("design implication" OR "design implications")	6	2
62	elder* AND impair* AND technolog*	180	10
63	elder* AND impair* AND comput*	334	9
64	elder* AND mobile	646	24
65	elder* AND ("human factor" OR "human factors")	38	4
66	elder* AND hci	14	4
67	elder* AND "interface design"	38	9
68	elder* AND tablet AND comput*	13	0
69	elder* AND tablet AND technolo*	23	0
70	elder* AND iPad	7	0
71	elder* AND ubiquitous AND comput*	49	0
72	elder* AND ubiquitous AND technolog*	58	1
73	elder* AND pervasive AND comput*	39	0
74	elder* AND pervasive AND technolog*	32	0
75	elder* AND interface AND comput*	115	26

continued ...

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Search Number	Boolean Search Terms	Total Number of Results	Number of Useful Articles
76	elder* AND interface AND technolog*	111	26
77	dementia AND accept* AND technol*	48	3
78	dementia AND accept* AND comput*	46	3
79	dementia AND "user acceptance"	3	1
80	dementia AND personal* AND technolog*	55	4
81	dementia AND personal* AND comput*	64	6
82	dementia AND interact* AND personal*	159	2
83	dementia AND interface AND personal*	23	3
84	dementia AND ergonom* AND technolog*	2	1
85	dementia AND ergonom* AND comput*	6	3
86	old* AND accept* AND technol*	497	38
87	old* AND accept* AND comput*	607	18
88	old* AND "user acceptance"	33	6
89	old* AND personal* AND technolog*	632	17
90	old* AND personal* AND comput*	564	14
91	old AND interact* AND personal*	926	7
92	old AND interface AND personal*	56	7
93	old* AND ergonom* AND technolog*	62	10
94	old* AND ergonom* AND comput*	115	25

continued ...

... continued

Search Number	Boolean Search Terms	Total Number of Results	Number of Useful Articles
95	elder* AND accept* AND technol*	194	21
96	elder* AND accept* AND comput*	74	9
97	elder* AND "user acceptance"	25	5
98	elder* AND personal* AND technolog*	185	9
99	elder* AND personal* AND comput*	108	8
100	elder* AND interact* AND personal*	255	5
101	elder* AND interface AND personal*	41	6
102	elder* AND ergonom* AND technolog*	15	2
103	elder* AND ergonom* AND comput*	14	6
104	"silver surfer" OR "silver surfers"	22	0
105	old* AND adopt* AND technolog*	750	32
106	old* AND adopt* AND comput*	337	14
107	dementia AND adopt* AND technolog*	31	5
108	dementia AND adopt* AND comput*	9	1
109	old* AND mobile AND comput*	394	15
110	old* AND mobile AND technolog*	419	21
111	elder* AND adopt* AND technolog*	141	16
112	elder* AND adopt* AND comput*	48	8
113	(Aged OR Aging OR Ageing) AND interact* AND technolog*	538	24

continued ...

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Search Number	Boolean Search Terms	Total Number of Results	Number of Useful Articles
114	(Aged OR Aging OR Ageing) AND interact* AND comput*	668	31
115	(Aged OR Aging OR Ageing) AND "user experience"	19	3
116	(Aged OR Aging OR Ageing) AND experience AND comput*	446	18
117	(Aged OR Aging OR Ageing) AND experience AND technolog*	459	20
118	(Aged OR Aging OR Ageing) AND accessib* AND comput*	138	8
119	(Aged OR Aging OR Ageing) AND accessib* AND technolog*	151	10
120	(Aged OR Aging OR Ageing) AND usab* AND comput*	53	13
121	(Aged OR Aging OR Ageing) AND usab* AND technolog*	66	8
122	(Aged OR Aging OR Ageing) AND ("design considerations" OR "design consideration")	15	0
123	(Aged OR Aging OR Ageing) AND ("design implications" OR "design implication")	6	0
124	(Aged OR Aging OR Ageing) AND impair* AND technolog*	258	14
125	(Aged OR Aging OR Ageing) AND impair* AND comput*	655	9
126	(Aged OR Aging OR Ageing) AND mobile AND technolog*	205	12
127	(Aged OR Aging OR Ageing) AND mobile AND comput*	111	7
128	(Aged OR Aging OR Ageing) AND ("human factor" OR "human factors")	75	7
129	(Aged OR Aging OR Ageing) AND hci	62	2
130	(Aged OR Aging OR Ageing) AND "interface design"	30	13
131	(Aged OR Aging OR Ageing) AND tablet AND comput*	40	0
132	(Aged OR Aging OR Ageing) AND tablet AND technolo*	29	1

continued ...

... continued

Search Number	Boolean Search Terms	Total Number of Results	Number of Useful Articles
133	(Aged OR Aging OR Ageing) AND iPad	15	0
134	(Aged OR Aging OR Ageing) AND ubiquitous AND comput*	33	0
135	(Aged OR Aging OR Ageing) AND ubiquitous AND technolog*	46	0
136	(Aged OR Aging OR Ageing) AND pervasive AND comput*	29	0
137	(Aged OR Aging OR Ageing) AND pervasive AND technolog*	27	0
138	(Aged OR Aging OR Ageing) AND interface AND comput*	539	41
139	(Aged OR Aging OR Ageing) AND interface AND technolog*	182	18
140	(Aged OR Aging OR Ageing) AND accept* AND technol*	279	20
141	(Aged OR Aging OR Ageing) AND accept* AND comput*	343	9
142	(Aged OR Aging OR Ageing) AND "user acceptance"	16	3
143	(Aged OR Aging OR Ageing) AND person* AND technolog*	331	13
144	(Aged OR Aging OR Ageing) AND person* AND comput*	468	11
145	(Aged OR Aging OR Ageing) AND interact* AND person*	648	4
146	(Aged OR Aging OR Ageing) AND interface AND person*	46	4
147	(Aged OR Aging OR Ageing) AND ergonom* AND technolog*	30	3
148	(Aged OR Aging OR Ageing) AND ergonom* AND comput*	58	6
149	(Aged OR Aging OR Ageing) AND adopt* AND technolog*	293	13
150	(Aged OR Aging OR Ageing) AND adopt* AND comput*	170	4
TOTAL		25828	1340

## APPENDIX

### D

# THE DESIGN AND EVALUATION OF A THEORY-BASED REMINISCENCE APPLICATION

## D.1 EFG Questions

### D.1.1 Reminiscence

1. Do you think about the past?
  - If yes, is there anything specific that prompts this?
  - If no, is there a reason?
2. How do you currently store memory prompts (such as music, video, and photographs)?
3. Have you attended reminiscence groups in the past?
  - Did you enjoy them?
  - If yes, what made it enjoyable?
  - If no, what stopped it being enjoyable?

4. Have you created a memory book?

- If yes, do you use it often?

### D.1.2 Computers and Technology

1. Do you own any computers / tablet computers / mobile phones / smart phones?

2. If you do own technologies:

- Do you use them regularly?
- What made you decide to purchase them / incorporate them into your life?
- Do you both use the technology, or is it just one person?
  - If no, is there a reason it is not used by one person?

3. If don't own technologies,

- Is there a reason?
- Is there something which can be done to overcome this reluctance? - whether to ask is dependant on answer to previous question.

4. Have you encountered any problems using technology?

- Computer-related problems
- Tablet- / Smartphone-related problems
- How did you overcome the problems?
- Did you turn to anyone for additional support?

### D.1.3 Reminiscence Application

1. Would you be interested in using a tablet computer to manage the storing and viewing of prompts for talking about the past?

- If no, is there a specific objection?

2. How do you feel about the idea of linking multiple stimuli together, for example, a photograph and a piece of music together?

3. How do you feel about the use of grouping memories together, for example, grouping all your wedding photographs together to remember that day specifically?

- What would you call that? - Group, Categories, Keywords

4. Would you want to be able to search for a specific memory?
5. Is there something specific you would want to call the program? Are there any specific requirements you have for the system? - for example, the ability to change memories?



## D.2 PFG Evaluation Grids

### Prototype Number: 1

I like ...

Size of screen

I dislike ...

Switches off

**I would add ...**

**I would remove ...**

**Prototype Number: 2**

**I like ...**

**I dislike ...**

**I would add ...**

**I would remove ...**

**Prototype Number: 1**

**I like ...** being able to use the music  
the idea of portability  
the ability to change text size  
and the notes relating to each picture to help as a  
reminder  
to be able to record a story in own words.  
Keyboard is clear.  
Set of instructions – concise + not too many pages.

**I dislike ...**  
keep going to sleep! Switches off music unfortunately  
tablet difficult  
not being able to see what I'm typing

**I would add ...**

ability to 'tip' the tablet.  
vibrant home button.

**I would remove ...**

**Prototype Number: 2****I like ...**

being able to see what I type.

The idea of hiding memories.

**I dislike ...**

getting rid of keyboard between  
Memory name and Type story.

⚡ Type story Record story Optional Confusing  
Change in colour of buttons with angle of screen.

**I would add ...**

Which memory is being held .

**I would remove ...**



## D.3 Beta Testing Focus Group

### D.3.1 Beta Testing Focus Group Questions

1. How was your experience of using the application?
  - What is the main type of memories you entered (stories, photographs, or music)?
2. Did the application seem beneficial to you?
3. Is there anything you would change about the application? - add / modify / remove
4. Did you use the ability to add stories as both text and audio?
  - Is this something you find useful, or would it be best to remove that feature?
5. Would you want to continue using the application?
  - If no, is there a particular reason?
6. How easy did you find the application to use?
7. Did you encounter any problems using the device?
8. Did you both use the application, or did one person lead the reminiscence?
  - If only one person:
    - Which person mainly used the application?
    - Why was it only one person?
    - Is there anything which could be done to encourage the other person to use the application?
9. What help would you like to be included within an onscreen help section?
10. What help would you like included on a “crib” sheet?

### D.3.2 Completed Problems Encountered Sheet

## D.3.3 Completed Problems Encountered Sheet

School of  
ComputingSchool of Computing  
University of Portsmouth  
Buckingham Building Lion  
Terrace  
Portsmouth PO1 3HE  
United KingdomT: +44 (0)23 9284 6363 F:  
+44 (0)23 9284 6364Problems EncounteredInstruction 5

"Photo fun" opened &amp; had to be closed

Instruction 10To set list of files under Android, had to  
click on "Android D:"Instruction 14No "eject" on menu. Had to access "eject" via  
"Show hidden icons"

\* Transferred photo & some music.  
 Found photo ~~once~~ <sup>but</sup> couldn't ~~again~~ <sup>play</sup> music.  
 Couldn't ~~start~~ music.

\* "Memories" needs its own written  
 instructions! AS had initial difficulties

\* ~~Took new photo & lost it!~~

\* Volume controls strange

\* Got "memories has stopped" message  
 when exiting from 'photo + music'

- \* To show in "Show all Memories"  
have to show in "Show Single Memory"  
first
- \* Cannot re-orientate photos through 90°
- \* 

---

said she would use
- \* Need to be able to delete  
memories as well as hide

## D.4 Acceptance Testing Questions

1. Researcher to download data. An analysis tool was built to quickly analyse the raw data to show the number and type of memories included within the app.
2. What was the most popular memory type?
  - Was there a reason for this?
3. Did you find the application easy to use?
4. Did you like the application?
5. Did you both use the application?
6. When entering the memories, how did you feel?
7. Just after entering the memories, how did you feel?
8. How did you feel when using the application to view your memories?
9. How did you feel just after using the application to view your memories?
10. Did you use it often?
11. Was there a particular time you used it?
12. Would you want to continue using it in the future?
13. Is there any other comments you would like to add?

## APPENDIX

### E

## PUBLICATIONS

The following sections contain copies of the articles published as part of this research project.

## E.1 Can Ubiquitous Devices Utilising Reminiscence Therapy be Used to Promote Well-being in Dementia Patients? An Exploratory Study

### Can Ubiquitous Devices Utilising Reminiscence Therapy be Used to Promote Well-being in Dementia Patients? An Exploratory Study

Claire Ancient<sup>1</sup>, Alice Good<sup>1</sup>, Clare Wilson<sup>2</sup>, Tineke Fitch<sup>1</sup>

<sup>1</sup>University of Portsmouth, School of Computing, Portsmouth, United Kingdom  
{claire.ancient, alice.good, tineke.fitch}@port.ac.uk

<sup>2</sup>University of Portsmouth, Department of Psychology, Portsmouth, United Kingdom  
clare.wilson@port.ac.uk

**Abstract.** This exploratory study aimed to assess whether ubiquitous devices could be used to facilitate person-centred reminiscence therapy. In order to test this approach to delivering a reminiscence therapy intervention, a tablet application was designed (using participatory design) and tested by the carers of people with dementia. The study showed that there is the potential to utilise the recent advances in mobile technology to facilitate reminiscence therapy. However, it did not provide conclusive proof that the device would be effective in its delivery of reminiscence therapy, but further research will aim to explore this.

**Keywords:** Dementia, Reminiscence Therapy, Ubiquitous Devices.

#### 1 Introduction

The aim of this study was to establish whether a mobile application could be used to facilitate personalised reminiscence therapy within the home environment by people with dementia and their carers.

Dementia is a devastating progressive disease. It is characterised by symptoms, including memory loss, mood changes and problems with reasoning and communication [1]. Current estimates suggest that over 800,000 people in the UK are living with dementia, with this figure set to exceed one million by 2021 [2].

With a rapidly increasing population of people with dementia and no cure on the horizon, steps need to be taken to try and manage the symptoms associated with the condition. Reminiscence therapy has the potential to do exactly that. By focusing on the early memories of an individual, it can help to create a sense of self, improve communication, improve one's mood and promote well-being [3].

##### 1.1 Dementia

The main cause of dementia is damage to the brain, either due to certain diseases or a series of mini-strokes. There are four main types of dementia: Alzheimer's Disease,

Vascular Dementia, Dementia with Lewy Bodies and Fronto-temporal Dementia. Alzheimer's disease is the most common form of dementia, with 62% of people being diagnosed with this form [2].

Despite extensive research, there is currently no cure for dementia. Medications can be prescribed to people with Alzheimer's disease in order to slow the progression of the disease or temporarily alleviate the symptoms. However, these are only effective for a limited period of time (normally between six months and a year) [4].

It is estimated that between 80% and 90% of people with dementia present with neuropsychiatric symptoms, including depression, apathy and irritability [5]. Although medication can be used to mitigate these symptoms of dementia, they should only be used in extreme cases. The National Institute for Clinical Excellence (NICE) recommends investigating alternative interventions and using medication as a last resort [6].

Due to the growing number of people being diagnosed with dementia, the need to provide high quality person-centred mental health care aimed at mitigating some of the associated symptoms has become a critical issue.

## 1.2 Reminiscence Therapy

Reminiscence therapy is one type of intervention which is often used as a "simple non-drug treatment" in order to mitigate some of the neuropsychiatric symptoms associated with dementia [6].

Reminiscence therapy utilises tangible prompts as a way of promoting conversation about shared past experiences, activities and events [3]. These prompts can include photos, music, archive recordings, newspaper clippings and anything else which can be used to stimulate memories. It has been described as "one of the most popular psychosocial interventions in dementia care" which is "highly rated by staff and participants" [3] and research has suggested that it can have positive effects on the participants [3, 7-10]. However, these results are yet to be conclusively established, using robust and unbiased evaluation techniques. In addition to this, Cohen-Mansfield et al. [9], suggest that participants are more involved and engaged with reminiscence therapy when the subject matter is personalised to them.

Reminiscence can provide the person with dementia the opportunity to reconstruct memories gained throughout life and provide a stabilising function. It can also be used to help the primary care-giver remember the person as they used to be before the dementia took hold. It can extend the carer's knowledge of the background, achievements and personality of the person they are caring for, which could eventually result in an improved person-centred care plan.

The diagnosis of dementia often causes the person to look at their failings. By focusing on the early memories, which remain intact for longer, reminiscence therapy is able to focus on the person's strengths. It reduces the likelihood of failing to remember and thus can provide reassurance in light of decreasing capacity to retain recent memories. In addition to the positive (and in some cases pleasurable) emotions felt, the person with dementia also experiences improved communication skills and can confidently discuss their earlier memories [7].

Reminiscence therapy also has the potential to help people with "other mental health conditions where depression and general low mood are common" [11]. With waiting lists of up to two years for some talking therapies [12], ubiquitous devices implementing reminiscence therapy could provide an important self-soothing function for people with mental health problems.

### 1.3 The Use of Ubiquitous Devices

With their increased capacity and improved portability, ubiquitous devices have the potential to facilitate personalised reminiscence therapy.

Currently, reminiscence therapy is performed as a group activity using generic memory prompts. Preparation is a time-consuming process as facilitators must generate a theme for the week and gather relevant materials [13]. Reminiscence is rarely carried out as a one-to-one activity using personal memorabilia. In utilising the power of ubiquitous devices, reminiscence therapy could become person-centred through the use of the individual's own photos, thus enhancing the participant's interaction.

Research by Alm et al. [14], has shown that people with dementia are able to adapt to and interact with touch screen environments. With this in mind, a tablet PC could be used to provide mobility to the users, enabling reminiscence therapy to become an activity which can occur whenever and wherever it is appropriate and convenient.

## 2 Method

This study was approached from a user-centred perspective, with the carers of people with dementia included at all stages of the design process. It was split into four phases: an initial study, application design, a prototyping session and finally user testing.

### 2.1 Initial Study

The initial study aimed to assess the perceived nature of reminiscence therapy, identify the types of prompt which evoke memories for both the person with dementia and their carer and also identify usability issues experienced whilst using a computer or touch screen device.

Originally, the initial study was designed to be a focus group involving six carers over the age of 65, who were approached a week before the intervention. However, one participant was due to be away on the planned date for the focus group, but was keen to take part. This led to five participants taking part in the focus group and one interview.

Both the focus group and the interview were semi-structured, with a standard list of questions, enabling the possibility of modification to questions or to include supplementary enquiries for clarification. It also meant that should the participants feel that they were unable to answer some of the questions; these could either be missed out or rephrased.



## 2.2 Application Design

The application was designed based on the findings of a literature review together with additional information gained as part of the initial study. These designs were then evaluated by carers of people with dementia as part of the prototyping session.

## 2.3 Prototyping

Initially, two prototyping sessions were planned: a low-fidelity prototype session using paper-based designs and a high-fidelity session which employed the ubiquitous device. However, during the initial focus group, it came across that the carers of people with dementia were struggling to envisage the application. For this reason, it was decided that only high-fidelity prototyping should be carried out. This would allow the potential users to assess the actual usability of the application.

Five potential users were given a set of tasks to carry out as part of the prototyping session. These activities were designed to test all the possible ways the user could interact with the system. The users were observed as they completed the tasks, with any problems encountered recorded. On completion of the activities, the carers were encouraged to discuss their opinions of the system, together with any changes they felt would be beneficial.

## 2.4 User Testing

This phase of the study was designed to evaluate the perceived effectiveness of the application. Two potential system users, who both have extensive experience of caring for a person with dementia, were used to assess the system.

Similarly to the prototype testing, the user testing involved the completion of several tasks aimed at testing the basic functionality. They were also designed to ensure that the users had interacted with the system sufficiently to form an opinion on the feasibility of utilising the application to facilitate reminiscence therapy. During the testing session, the users were observed to determine whether there were any problems with interaction. Subsequent to the testing session, the carers were interviewed to allow them to discuss their thoughts of the system.

# 3 Results

## 3.1 Initial Study

Whilst the participants of the focus group felt that reminiscence therapy would have no effect on their partners at the current point in time, they did believe that it would have been beneficial at an earlier stage of the illness. By contrast, the interviewee considered reminiscence therapy to be useful at the point of execution, but felt it had no lasting effect on her partner.

During the focus group it became apparent that the carers had the perception that reminiscence therapy can only be done as part of a group session, for a specific

amount of time. Although reminiscence therapy is often carried out as part of a group following a set 'prescription', it can be just two people remembering their past together at home. It follows that for the application to be useful the carer's preconceptions of reminiscence therapy need to be challenged and changed.

One couple had participated in a 12-week programme of group reminiscence therapy several years ago. The carer felt that her husband did enjoy the group and "came to life" during the sessions. She also commented that despite his worsening condition, music still provokes memories, with him often able to remember the words to songs from an earlier age.

It was generally agreed by the focus group that music effectively evoked memories for both the carer and the person with dementia. One carer stated that she has CDs containing old music which reminds them of when they first met and revives memories for her husband. The group did agree that photos do stir up memories; however, they were often inaccurate, for example, a person mistaking his grandchildren for his children. This caused the carers frustration, especially when their partners seem able to remember incorrect memories over actual recollections. In addition to this, the participants expressed that taking part in discussions prompted further memories, much like a spider-web fanning out. One participant found that her husband could clearly remember poems from when he was younger. Finally, they felt that there were times when a word would stimulate memories, the example given being "mardy" which reminded the participant of her northern upbringing.

Of the six participants only one person had previously used a tablet PC. He found that his wife became visibly distressed when he used a laptop computer. However, she appears to be unaffected by him using a tablet PC. An observation of the interviewee whilst using the tablet PC showed that she had considerable trouble when using the "pinch-zoom" functionality. This will need to be considered during the design process.

### 3.2 Application Design

Designing an application for use by people with dementia needs to consider not only the effects of the condition, but also the changes which naturally occur as a person ages. In addition to this, as a group of people ages, their individual needs become increasingly diverse [15].

Due to the declining short term memory of people with dementia, the application has been designed to reduce the volume of information which needs to be remembered. For example, if the user wants to change an item or remove it completely they are able to do this directly from the reminiscence screen. This eliminates the need to remember which item they intended to alter whilst changing their location in the application.

Often, mobile devices will have too much functionality [16]. This leads to increased cognitive load due to the complexity, however when it comes to older users, it is desirable to reduce the amount of effort placed on the brain, as this capacity is in decline. This is even more important for people with dementia whose cognitive skills will be dramatically reduced when compared to someone who does not suffer from

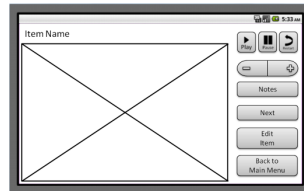
the condition. By simplifying the functionality on each screen and increasing the size of elements, the cognitive load is reduced and the users will not be overwhelmed by the number of possible operations available to them [17]. It is however, important to remember not to simplify the navigation too much. By cutting the number of menu items shown on a screen to just one item, more harm may be done than good. It will stop the users from seeing the alternatives and will also hide the navigation structure from them [16].

In addition to this, as a person grows older there is a natural decline in their ability to extract relevant information in a field of distractors [18]. This is particularly important when trying to facilitate reminiscence therapy, as the focus should be on the memory prompt rather than the interface. Therefore, to avoid distractions, the interface has been designed to be as simple as possible, bearing in mind the dangers of over-simplification mentioned above. This ensures that the person with dementia focuses on the reminiscence item rather than the interface, promoting enhanced interaction with the process.

In order to maximise the readability of the interface, designers need to consider the colour of the background in relation to the foreground text. Research suggests that there should be a high contrast between background and foreground colours [19]. It is suggested that the best colours to use are black text on a white background [18]. However, Lorenz & Oppermann [20] agree that whilst the readability is best with the black text, white background combination, their users commented that the white background was too bright and made them uncomfortable. This led them to propose a grey or orange background with black, white or turquoise fonts. In this application, a white background has been chosen to maximise readability. However, to combat the discomfort caused by the harsh background, the interface components will be made as large as possible, without compromising the flow of the interface. This will allow the text size to be made as large as possible, which agrees with the suggestions made by Dickinson et al. [19].

The application allowed the users to link music and images together, in order to provide the potential for dual stimulation of memories. In addition to this, the users were able to name their memories and provide extra notes to act as supplementary memory prompts.

Figure 1 shows the interface for the main reminiscence screen. It provides all the functionality required to facilitate reminiscence therapy. In order to maintain the consistency of the layout when there is no music assigned to an item, the play, pause and restart buttons will be hidden allowing for no change in the positioning of the subsequent buttons. This will remove any frustration felt from buttons which appear to have no functionality, without requiring the users to search for buttons that are in different positions.



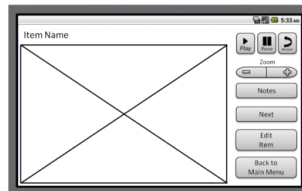
**Fig. 1.** Reminiscence screen

### 3.3 Prototyping

In general, the users felt that the system was easy to use. The prototyping session provided an insight into the problems which could be encountered by the users allowing adjustments to be made to the system in order to eliminate these issues.

The main issue identified by all the participants in the prototyping session was the colour scheme. Contrary to the findings of the literature review, they did not have a problem with the brightness of the white background; instead they felt that it was a "boring" colour scheme. The carers were encouraged to suggest the colours they would particularly like to see in the interface. The majority stated that calming pastel colours (such as light yellow or purple) would be the ideal option, as they would make the interface appear "cheerful".

The users struggled to identify the zoom buttons in the interface. Therefore by adding a label to the zoom buttons, this would allow the users to quickly identify their use. They did, however, like the ability to zoom into images as it enabled them to see additional detail which had been overlooked. This feature allowed the carer to emphasise parts of a photo to the person with dementia, such as the face of a loved one. The main reminiscence screen was adapted to take this suggestion into account, see figure 2.



**Fig. 2.** Updated Reminiscence screen to reflect the labelled zoom button.

All the participants had problems reading the notes before they disappeared from view. They quickly realised that if they kept pressing the notes button, the pop-up remained visible for longer. This is not an ideal solution; therefore, in the final system the length of time the pop-up remained on the screen needed to be increased.

When adding and changing items, the users struggled to decide which button related to each section of the interface. For example, the participants couldn't decide which button added an image. It was suggested that this problem would be eliminated by switching the position of the button with the text field (in the case of the music) and the image preview (for the photo). This made the associations clearer to the user.

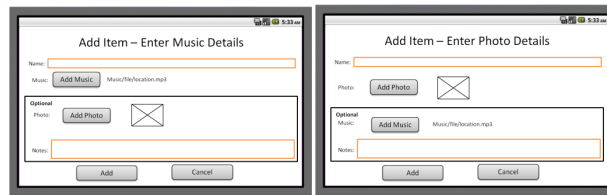


Fig. 3. Updated Add Music and Add Photo screens

### 3.4 User Testing

Both testers felt that the application would be beneficial to them for facilitating reminiscence therapy with their respective relatives. They commented that a large number of their photographs are already saved on their personal computer, and as such would be easy to transfer.

One tester commented that the initial input of personal memories would be extremely time consuming and quite difficult using the Android keyboard. However, after the first series of memories had been entered, it would simply be a case of maintaining the database and adding extra memories when necessary. Conversely, the other tester felt that the input process would provide an additional opportunity to reminisce, allowing input from the person with dementia, which could result in a more comprehensive set of memory prompts.

When asked to zoom in on an image, both users approached the task differently. One tester decided to use the buttons included on the interface, whereas the other user automatically exploited the pinch-zoom functionality. This justified the inclusion of both methods of enlarging the picture in order to reduce unassisted recall.

One user found it frustrating that having pressed the next button the ability to return to the previous image was absent. This was perpetuated by the buttons being situated in close proximity, as the user found it easy to accidentally press the adjacent button when intending to display the photo notes.

The testers felt the background colour scheme used had an overall calming effect. The testers commented that the background colour did not detract from the purpose of the screen, ensuring that the focus was maintained on the reminiscence item rather than the surroundings. Despite this, care needs to be exercised when concluding that the colours are appropriate, due to the variety of the potential users' visual needs.

Despite increasing the amount of time available for the notes to be displayed on the screen, both users still found difficulty in reading the entire contents of the pop-up before it disappeared. This suggests that either there needs to be an improved method of displaying the notes on the screen or the length of time that the pop-up is displayed

should be increased further. The latter is possible; however, there is the risk that there will always be someone who reads the pop-up slower than others.

## 4 Conclusion

This study aimed to assess whether ubiquitous devices are a practical method for facilitating reminiscence therapy for people with dementia and their carers. Whilst this study does not categorically prove that ubiquitous devices are effective in delivering a reminiscence therapy intervention, it does show the potential. The prototyping stage increased the interest of carers in the application, as they were able to foresee the possible advantages of using a ubiquitous device to facilitate reminiscence therapy.

The initial study found that some carers are averse to trying new methods of stimulating their partners' memories. This is not due to a lack of commitment, but to the opinion that arguably there will be no positive effect so "there will be no point in trying". There also appears to be a belief that reminiscence therapy can only take place in a group, for a set period of time. This assumption needs to be challenged, as reminiscence can occur at any time.

Should reminiscence therapy be adopted during the earlier stages of dementia, a routine may be instilled which enables both the person with dementia and the carer to benefit from the recollection of shared memories. By developing the catalogue together, whilst their treasured memories remain intact, allows for increased participation. The burden of creating and maintaining the flow of conversation during reminiscence on the carer will be reduced [13].

Future research will investigate whether the application is designed sufficiently to be used by people with dementia. Once this has been established, the application will be tested to investigate whether it has a measurable effect on the well-being of people with dementia and their carers. In addition to establishing the use of ubiquitous devices to facilitate reminiscence therapy for people with dementia and their carers, further research will be completed to investigate use with other user groups (such as people with depression, borderline personality disorders and other mental health problems).

## References

1. What is Dementia?,  
[http://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=106](http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=106).
2. Demography,  
[http://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=412](http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=412).
3. Woods, B., Spector, A. E., Jones, C. A., Orrell, M., Davies, S. P.: Reminiscence Therapy for Dementia. Cochrane Database of Systematic Reviews. (2009)
4. Drug treatments for Alzheimer's disease,  
[http://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=147](http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=147)
5. Steinberg, M., Tschanz, J., Corcoran, C., Steffens, D., Norton, M., Lyketsos, Breitner, J.: The Persistence of Neuropsychiatric Symptoms in Dementia: The Cache County Study. *International Journal of Geriatric Psychiatry*. 19, 19-26 (2004)

6. Drugs used to relieve behavioural and psychological symptoms in dementia, [http://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=110](http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=110).
7. Thorgrimsen, L., Schweitzer, P., Orrell, M.): Evaluating Reminiscence for People with Dementia: a Pilot Study. *The Arts in Psychotherapy*, 29, 93-97 (2002)
8. Hsieh, C., Chang, C., Su, S., Hsiao, Y., Shih, Y., Han, W., Lin, C.: Reminiscence Group Therapy on Depression and Apathy in Nursing Home Residents with Mild-to-Moderate Dementia. *Journal of Experimental and Clinical Medicine*, 2, 72-78 (2010)
9. Cohen-Mansfield, J., Thein, K., Dakheel-Ali, M., Marx, M. S.: The Underlying Meaning of Stimuli: Impact on Engagement of Persons with Dementia. *Psychiatry Research*, 177, 216-222 (2010)
10. Westerhof, G.J., Bohlmeijer, E., Webster, J.D.: Reminiscence and mental health: a review of recent progress in theory, research and interventions. *Aging & Society*, 30, 697-721 (2010)
11. Good, A., Wilson, C., Ancient, C., Sambhathan, A.: A Proposal to Support Wellbeing in People With Borderline Personality Disorder: Applying Reminiscent Theory in a Mobile App. In: *The ACM conference on Designing Interactive Systems*. ACM Press, New York (2012)
12. The Fundamental Facts: The latest facts and figures on mental health, [http://www.mentalhealth.org.uk/content/assets/PDF/publications/fundamental\\_facts\\_2007.pdf?view=Standard](http://www.mentalhealth.org.uk/content/assets/PDF/publications/fundamental_facts_2007.pdf?view=Standard)
13. Astell, A., Ellis, M. P., Bernardi, L., Alm, N., Dye, R., Gowans, G., Campbell, J.: Using a Touch Screen Computer to Support Relationships between People with Dementia and Caregivers. *Interacting with Computers*, 22, 267-275 (2010)
14. Alm, N., Dye, R., Gowans, G., Campbell, J., Astell, A., Ellis, M.: Designing an Interface Usable by People with Dementia. In: *Proceedings of the 2003 Conference on Universal Usability*, pp 156-157. ACM Press, New York (2003)
15. Gregor, P., Newell, A. F., Zajicek, M.: Designing for Dynamic Diversity - Interfaces for Older People/ In: *Proceedings of the Fifth International ACM Conference on Assistive Technologies*, pp 151-156. ACM Press, New York (2002)
16. Ziefle, M.: Information Presentation in Small Screen Devices: The Trade-Off between Visual Density and Menu Foresight. *Applied Ergonomics*, 41, 719-730 (2010)
17. Sayago, S., Blat, J.: Telling the Story of Older People E-mailing: An Ethnographic Study. *International Journal of Human-Computer Studies*, 68, 105-120 (2010)
18. Hawthorn, D.: Possible Implications of Aging for Interface Designers. *Interacting with Computers*, 12, 507-528 (2000)
19. Dickinson, A., Newell, A. F., Smith, M. J., Hill, R. L.: Introducing to the over-60s: Developing an Email System for Older Novice Computer Users. *Interacting with Computers*, 17, 621-642 (2005)
20. Lorenz, A., Oppermann, R.: Mobile Health Monitoring for the Elderly: Designing for Diversity. *Pervasive and Mobile Computing*, 5, 478-495 (2009)

## E.2 Issues with Designing Dementia Friendly Interfaces

### Issues with Designing Dementia-Friendly Interfaces

Claire Ancient, Alice Good

University of Portsmouth, School of Computing, Portsmouth, United Kingdom  
{claire.ancient, alice.good}@port.ac.uk

**Abstract.** People with dementia are a rapidly growing demographic. In a world which is increasingly dependent on computing, this large group of people is becoming technologically isolated, due to the ill-suited design of interfaces. This paper looks at the possible 'roadblocks' which need to be considered when designing interfaces in order to ensure they are dementia-friendly. By considering the unique needs of a person with dementia, designers can ensure that their software is accessible to this demographic, hence potentially reducing the feelings of technological exclusion.

**Keywords:** Dementia, Interface Design, Accessibility

#### 1 Introduction

Dementia is a degenerative brain condition which is not a natural part of the aging process. Generally, the symptoms of dementia include memory loss, communication problems and mood changes. However, each person will experience the condition differently depending on the type of dementia and their individual circumstances [1].

In the next 8 years, the number of people with dementia in the UK is expected to reach 1 million [2]. In a world where computing is increasingly ubiquitous, it is important that all users are catered for when designing interfaces. Research suggests that elderly people are keen to utilise the latest technology [3, 4] in spite of the fact that their understanding of the products is minimal. When this limited knowledge is combined with inappropriately designed interfaces, it could enhance the person with dementia's feelings of technological isolation. The result being an entire demographic which is being alienated by interface designers, possibly leading to a greater divide between the digital native and digital immigrants [5].

Designing interfaces for people with dementia is difficult. It involves a delicate balance of accessibility features, usability features and elements which are designed to improve the user experience. In addition to this, the people with dementia will not only suffer from condition related decline, but also problems linked to the natural aging process. Despite the rapidly increasing number of computer users with dementia, the W3C WAI currently has no specific guidelines designed to make interfaces dementia-friendly [6]. There are existing guidelines which inform the development of interfaces allowing access to people with age-related decline. However, these do not



take into account the special needs of a person who is living with a diagnosis of dementia.

The lack of definitive guidelines for designing dementia-friendly interfaces is understandable. As the average age of a group of people rises, the diversity of their individual needs increases [7, 8]. This makes designing a "one size fits all" interface challenging.

This paper utilises existing literature, together with observations from a pilot study [9] in order to discuss the possible implications of dementia on the design of interfaces. It considers the three possible areas where dementia will have an impact on the design of interfaces: cognitive impairments, motor impairments and visual impairments. This study is part of a wider research project with the aim to produce applications designed to improve the well-being of people with mental health problems (including dementia). By ensuring the applications are dementia-friendly, the researchers are hoping to maintain the focus on improving well-being, rather than reducing it through inappropriate interface design.

## 2 Accessibility Considerations

When considering accessibility for older people (regardless of a dementia diagnosis), three different areas should be considered: cognitive impairments, motor impairments and visual impairments. However, during interaction with an interface multiple abilities are brought into play simultaneously [7], with some abilities interacting with each other whilst others compensate for impairments. Therefore, these categories should be considered both in isolation and holistically to obtain a complete overview.

One of the main symptoms of dementia is short term memory loss [1]. Therefore, dementia-friendly interfaces need to account for this diminished ability. Interfaces should minimise the amount of information which the person with dementia is required to remember. The need to remember the relative position within the system could leave the person with dementia feeling disorientated if they fail to recall their location.

Older, inexperienced computer users will often struggle with new jargon [10], this will be accentuated for people with dementia who will sometimes have problems finding the correct word [1]. Ziefle found that when elderly people encounter unfamiliar items in a menu, they would have to learn both the new name together with its relative location [4]. This will be particularly challenging to people with dementia as the capacity to formulate new memories is significantly diminished.

Due to the similarities in symptoms with Parkinson's disease, the consideration of motor impairments is particularly important for people who have been diagnosed with Lewy body dementia [11]. This can accentuate the slower movements experienced during older age. It is essential to consider the increased response time of people with dementia (especially Lewy body dementia), when an interface expects a response within a specific length of time - such as 'time-outs' when completing an online form.

Often, older people struggle with complex movements, particularly if they are novel movements [7]. During a pilot study by Ancient et al. [9] it was observed that

an older person struggled with the "pinch-zoom" functionality of touch screen computing. Consideration of this is especially important for people who have dementia as some complex movements may always be novel to them regardless of the number of times they have been demonstrated. In addition, people with reduced motor skills often struggle to cope with manoeuvring scroll bars resulting in large jumps of the screen position, leading to disorientation [4, 7].

Hawthorn [7] discusses the limited typing ability of elderly people as an interface "barrier". During the pilot study, one participant commented on his struggle to type, suggesting that younger people are used to typing on smart devices, whereas his generation was not and as such found difficulty typing quickly.

As people grow older, their eyesight declines. There are significant declines in visual acuity (especially within a dimly lit environment), an increased sensitivity to glare, a reduction in the field of view, a decline in the ability to rapidly adjust to changing light and a decline in sensitivity to colours [7, 12]. In the case of people with dementia, the occipital lobe (which manages the visual information which is conveyed by the eyes) may become damaged. This leads to increased problems with perception as colour, shape and movement are processed by this part of the brain [13].

With regards to text size, it is generally agreed that the larger the font, the easier it is for elderly people to see [10]. However, care should be taken that the font is not increased to the point where scrollable windows are required to compensate for the bigger space needed to contain the text.

It is important to ensure that the readability is improved for all elderly users, with suggestions of reducing the density of the text [4]. However, there is increased significance to people with dementia as damage to the occipital lobe could cause difficulties in identifying objects and text [13]. By improving the readability, the brain will be provided with as much information as possible to produce a more accurate image.

Category	Considerations for Elderly People	Additional Considerations for People with Dementia
Cognitive Impairments		<ul style="list-style-type: none"> <li>• Short term memory loss [1]: <ul style="list-style-type: none"> <li>— Reduced ability to remember items</li> <li>— Disorientation when trying to recall relative location in the system</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>• Sometimes struggle to remember terminology [10] - often resulting in the need to remember both the name and location in the menu [4]</li> </ul>	<ul style="list-style-type: none"> <li>• Often struggle to find the correct word, enhancing the difficulty with terminology [1].</li> <li>• Reduced capacity to formulate new memories - difficult to learn both new word and menu location.</li> </ul>
Motor Impairments	<ul style="list-style-type: none"> <li>• Movements are slower</li> </ul>	<ul style="list-style-type: none"> <li>• Slower movements can be accentuated by symptoms of dementia with Lewy bodies</li> </ul>

		(which are similar to Parkinson's disease) [11]
	<ul style="list-style-type: none"> <li>Elderly people struggle with complex movements - particularly if they are novel [7].</li> </ul>	<ul style="list-style-type: none"> <li>May not be able to learn new complex motor skills.</li> </ul>
	<ul style="list-style-type: none"> <li>Find manipulating scroll-bars challenging, leading to disorientation [4, 7]</li> </ul>	
	<ul style="list-style-type: none"> <li>Reduced ability for typing [7].</li> <li>Comments made during a pilot study [9] suggest typing on a tablet or smartphone is not natural for older people.</li> </ul>	
Visual Impairments	<ul style="list-style-type: none"> <li>As people age, their eyesight ability declines [7, 12]</li> </ul>	<ul style="list-style-type: none"> <li>Damage to occipital lobe can cause problems with perception due to problems with interpretation in the brain [13]</li> </ul>
	<ul style="list-style-type: none"> <li>Larger text is easier to read for older people [10]               <ul style="list-style-type: none"> <li>Should avoid text becoming too big, so there is no requirement for scrolling windows</li> </ul> </li> </ul>	
		<ul style="list-style-type: none"> <li>Maximise readability in order to provide the occipital lobe with enough information to provide an accurate reading [13]</li> </ul>

Table 1. Summary of Key Design Considerations

### 3 Conclusion

Given the range of requirements for this user group, designing dementia-friendly interfaces will not be easy. However, with the number of people with dementia increasing, it will become a necessity of the interface design process, if we are to strive towards inclusiveness. By accounting for the additional needs of this important demographic, interface designers may be able to reduce feelings of technological isolation and improve interaction with modern technologies, by enabling a positive user experience.

The aim of future research will be to devise a set of guidelines to aid interface designers with the development of dementia-friendly interfaces. The diverse nature of

dementia symptoms together with the increased variability of individual needs as people get older certainly make this a difficult challenge.

Research has shown that older people are not averse to adopting new technologies [3, 4], if designers can ensure that their interfaces are accessible to people with dementia, a new realm of possible treatments aimed at mitigating the symptoms could be developed.

### References

1. Alzheimer's Society, What is Dementia?  
[http://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=106](http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=106).
2. Alzheimer's Society, Demography,  
[http://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=412](http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=412).
3. Chou, J., Hsiao, S.: A Usability Study on Human-Computer Interface for Middle-aged Learners. *Computers in Human Behavior*, 23, 2040-2063 (2007).
4. Ziefle, M.: Information Presentation in Small Screen Devices: The Trade-Off between Visual Density and Menu Foresight. *Applied Ergonomics*, 41, 719-730 (2010)
5. Holsapple, C., Pakath, R., Sasidharan, S.: A Website Interface Design Framework for the Cognitively Impaired: A Study In The Context Of Alzheimer's Disease. *Journal of Electronic Commerce Research*, 6, 291-303 (2005).
6. Web Accessibility Initiative, Web Content Accessibility Guidelines.  
<http://www.w3.org/WAI/intro/wcag.php>
7. Hawthorn, D.: Possible Implications of Aging for Interface Designers. *Interacting with Computers*, 12, 507-528 (2000)
8. Gregor, P., Newell, A. F., Zajicek, M.: Designing for Dynamic Diversity - Interfaces for Older People/ In: *Proceedings of the Fifth International ACM Conference on Assistive Technologies*, pp 151-156. ACM Press, New York (2002)
9. Ancient, Claire, Good, Alice, Wilson, Clare, and Fitch, Tineke (2013) Can Ubiquitous Devices Utilising Reminiscence Therapy be Used to Promote Well-being in Dementia Patients? An Exploratory Study. In *Ambient Assisted Living*, part of HCI International 2013, 21st - 25th July 2013, Las Vegas.
10. Dickinson, A., Newell, A. F., Smith, M. J., Hill, R. L.: Introducing to the over-60s: Developing an Email System for Older Novice Computer Users. *Interacting with Computers*, 17, 621-642 (2005)
11. Alzheimer's Society, What is Dementia with Lewy Bodies?  
[http://alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=113](http://alzheimers.org.uk/site/scripts/documents_info.php?documentID=113)
12. Lorenz, A., Oppermann, R.: Mobile Health Monitoring for the Elderly: Designing for Diversity. *Pervasive and Mobile Computing*, 5, 478-495 (2009)
13. Alzheimer's Society, The Brain and Behaviour.  
[http://alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=114](http://alzheimers.org.uk/site/scripts/documents_info.php?documentID=114)

## E.3 Considering People Living with Dementia when Designing Interfaces

### Considering People Living with Dementia when Designing Interfaces

Claire Ancient & Alice Good

School of Computing, University of Portsmouth  
Buckingham Building, Lion Terrace, Portsmouth, UK, PO1 3HE  
{claire.ancient, alice.good}@port.ac.uk

**Abstract.** Dementia is an escalating problem which is estimated to affect 35.6 million people worldwide. In an environment which is becoming increasingly dependent on technology, the interaction needs of people living with dementia is being ignored by interface designers. This paper aims to highlight the factors which should be considered when designing interfaces to be "dementia-friendly". The article draws on the limited previous research to suggest that interfaces need to consider two main factors: personalisation (which includes both accessibility and usability) and user acceptance (including the experience produced by the interfaces and barriers to technology adoption).

**Keywords:** Dementia; Interface Design; Personalisation; User Acceptance.

#### 1 Introduction

The worldwide prevalence of dementia is rapidly increasing. In 2012, the World Health Organisation estimated a figure of 35.6 million people worldwide living with the condition, a number which is expected to rise by 7.7 million each year [1]. In the UK, 1 in 3 people over the age of 65 will develop a form of dementia [2].

Dementia is the term used for a collection of conditions including Alzheimer's disease and Vascular dementia. It is caused by damage to the brain, either due to diseases or a series of strokes. Alzheimer's disease is the most common form of dementia, affecting between 60% and 70% of diagnosed cases [1]. However, there are many rarer causes of dementia. Whilst each dementia-causing condition will have its own set of specific symptoms, people living with dementia will often experience short-term memory loss, problems with communication and difficulties with concentration [3].

The condition is progressive; therefore, the symptoms of dementia will get worse over time. In addition, every person living with dementia will experience the condition in their own way. This is dependent on a number of factors including (but not limited to): the type of dementia diagnosed, their personality, the medication prescribed and the support network around them [4].

adfa, p. 1, 2011.  
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### 1.1 Importance of Technology

Despite a lack of understanding and experience, previous research suggests older people are willing to utilise recent advances in technology, particularly when the device is considered beneficial [5]. In addition, research by Rosenberg et al. [6] suggests that people with dementia are able to utilise well-known technologies at a competent level. However, combining this reduced knowledge with interfaces that have been poorly designed and implemented can hinder the interaction and amplify pre-existing feelings of technical isolation and inadequacy [7, 8].

Technology, with special emphasis on assistive technology, when applied in an effective manner has the potential to improve the quality of life for both the person living with dementia and their caregiver allowing users the possibility of remaining in their own home longer; thus reducing the cost of residential care [5, 9-12]. Furthermore providing the opportunity to access therapeutic interventions in the users own time would provide people living with dementia an increased feeling of independence and improved levels of satisfaction [13]. However, there is often a stigma attached to the use of assistive devices [14]. Therefore, care needs to be taken to ensure the assistive device is appropriate for the needs of the person with dementia and mitigates any feelings of inadequacy. Examples of assistive technology include devices to promote safer walking, telecare to ensure safety within the home environment and memory aids to compensate for a declining cognitive ability [9].

It is important to note, that when assistive technology is introduced it should aim to augment the daily caring activities, rather than replace them totally. Whilst it is vital to find alternative methods to improve day-to-day life for both the person living with dementia and their caregiver, technology should not replace the vital human contact aspect of caring for someone [15].

By not considering the interaction needs of people living with dementia, interface designers may be isolating their intended users and hence negating the potential effectiveness of the developed technology. This could lead to prospective users disregarding a technology which could enhance their quality of life, enabling them to remain within the community and increase their safety.

### 1.2 Objective

Using secondary research in the form of a literature review, this paper aims to investigate the factors which need to be considered when designing interfaces for people living with dementia. By considering the interaction difficulties encountered due to dementia-related cognitive decline, designers can ensure technology is easily utilised by people living with the condition.

## 2 Method

In order to achieve the objectives of this paper, a literature search using the Discovery Service tool provided by the University of Portsmouth was conducted. This tool allowed the search of multiple library resources, including ScienceDirect, IEEE Xplore

and the ACM Digital Library, to be explored simultaneously (for a full database listing visit: <http://www.port.ac.uk/library/infores/discovery/>).

Boolean logic was used to combine the keywords listed in table 1. This allowed the search results to be narrowed and ensured each of the title, abstract and subject terms were investigated for the inclusion of all keyword combinations. The Discovery search engine provides the functionality to search within the full text of a publication. However, in order to minimise the possible number of redundant results, it was decided not to utilise this functionality.

All the searches were limited to articles which have been published between January 2008 and December 2013. This ensured that only recent articles were obtained as part of the searching algorithm so as to only consider the most up-to-date knowledge and to obtain recommendations for the latest advances in technology, such as tablet computers.

**Table 1.** Search Keywords, chosen for their relevance to the topic reviewed

Dementia	Interact*
Comput*	Technolog*
"User experience"	Experience
Accessib*	Usab*
"Design considerations"	"Design implications"
Impair*	Mobile
"Human factor"	"Human factors"
HCI	"Interface design"
Tablet	iPad
Ubiquitous	Pervasive
Interface	Accept*
"User Acceptance"	Personal*
Ergonom*	Adopt*

After the initial searches had been completed, the inclusion criteria described in section 2.1 was applied based upon the publication abstract and the subsequent duplicate articles removed.

## 2.1 Inclusion Criteria

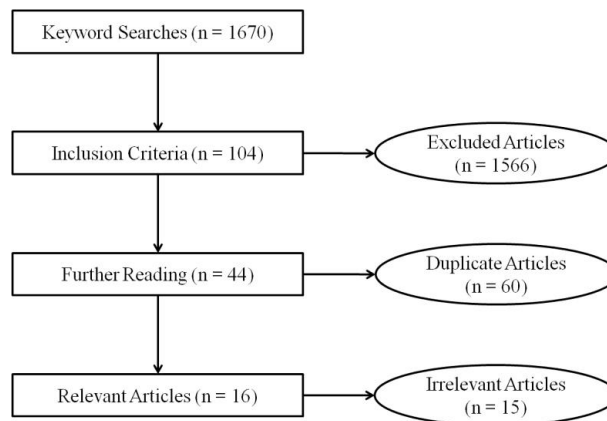
The following inclusion criteria were applied to the abstracts of the articles found as a result of the initial searches:

- Publications written in English
- Articles published in Academic Journals, Conference Proceedings and Books

- Publications where the focus is ensuring interfaces are suitable for people living with dementia (including accessibility, usability, user experience and user acceptance theory)
  - Articles focusing on the technology rather than the design have been excluded from this current study, but have been reserved for future research.

### 3 Results

The results of this study showed that in the last six years minimal research has been carried out into the interaction needs of people living with dementia. The diagram in figure 1 shows the process carried out in order to reduce the number of possible articles from 1670 publications after the initial search to just 16 relevant studies.



**Fig. 1.** Flowchart showing the process used to narrow the total number of articles.

The initial searches yielded a total number of 1670 potential articles which could be relevant to the current study. The application of the inclusion criteria (described in the previous section) to the article abstracts reduced the number of publications to 104. Table 2 shows the total number of results for each search term together with the number of potentially useful results.



**Table 2.** Search Results

Search Terms	Total Number of Results	Useful Results
dementia AND interact* AND technolog*	71	3
dementia AND interact* AND comput*	78	5
dementia AND “user experience”	0	0
dementia AND experience AND comput*	44	2
dementia AND experience AND technolog*	71	5
dementia AND accessib* AND comput*	21	3
dementia AND accessib* AND technolog*	24	2
dementia AND usab* AND comput*	17	6
dementia AND usab* AND technolog*	19	3
dementia AND “design considerations”	4	0
dementia AND “design implications”	0	0
dementia AND impair* AND technolog*	189	5
dementia AND impair* AND comput*	451	9
dementia AND mobile	96	4
dementia AND (“human factor” OR “human factors”)	12	0
dementia AND hci	6	1
dementia AND “interface design”	1	1
dementia AND tablet AND comput*	4	1
dementia AND tablet AND technolo*	4	1
dementia AND iPad	6	0
dementia AND ubiquitous AND comput*	5	0
dementia AND ubiquitous AND technolog*	3	1
dementia AND pervasive AND comput*	9	3
dementia AND pervasive AND technolog*	5	3
dementia AND interface AND comput*	64	9
dementia AND interface AND technolog*	20	5
dementia AND accept* AND technol*	48	3
dementia AND accept* AND comput*	46	3
dementia AND “user acceptance”	3	1
dementia AND person* AND technolog*	55	4
dementia AND person* AND comput*	64	6
dementia AND interact* AND person*	159	2
dementia AND interface AND person*	23	3

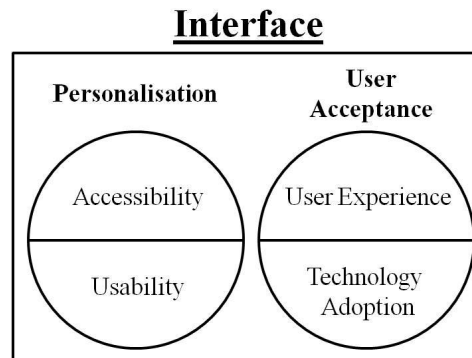
dementia AND ergonom* AND technolog*	2	1
dementia AND ergonom* AND comput*	6	3
dementia AND adopt* AND technolog*	31	5
dementia AND adopt* AND comput*	9	1

Once the inclusion criteria had been applied, the duplicate articles were removed to produce a final list of 44 articles to be further investigated. These articles were read to ensure they were applicable to the current study at which point 15 articles were excluded.

The final number of articles suitable for inclusion in this study was 16.

#### 4 Discussion of Relevant Articles

In previous research, when designing interfaces three main factors were considered: accessibility, usability and user experience [16]. However, when designing for people living with dementia, two main ideas need to be considered holistically: personalisation and user acceptance, as shown by figure 2.



**Fig. 2.** Diagram to show the factors involved in interface design.

##### 4.1 Personalisation

The concept of personalisation involves the adaption of the user interface in order to specifically meet the needs of the user. In this sense, personalisation would include features to ensure the interaction was both accessible and usable. Personalisation would be an ideal solution to catering for a wide variety of needs within a single group of users, making the technique appropriate for use with people living with dementia at all stages of the condition's progression [13].

A diagnosis of dementia does not automatically imply the person is unable to utilise technology to its full potential. Every person is different and should be treated as such. Any perceived interaction difficulties should be assessed on a case by case basis rather than making generalised assumptions about the state of a person's cognitive ability [6, 17].

The amount of personalisation an interface requires is a delicate process. Just like a human caregiver, it is important to ensure the right amount of support is provided in a timely manner. Both the system and the caregiver must provide the appropriate amount of assistance to empower the person living with dementia to complete the task without deskilling taking place [18]. As the person living with dementia's cognitive ability declines, the amount of support which is required from the system will increase. This leads to the requirement for the personalisation to be dynamic, and as such be able to adjust to the changing needs of the user over time [18].

In addition, the process of personalisation should tailor the interface to provide the necessary support to compensate for a person with dementia's declining abilities whilst maintaining the abilities which currently remain intact [5]. However, care needs to be taken that the interface is not simplified to a level which could patronise the person with dementia [10, 19]. Mihailidis et al. [13] argue that the interface should "start users with the most minimal possible starting point appropriate for their current level of abilities", reducing the likelihood of feeling overwhelmed. Rosenberg et al.'s study [5] showed that one concern of caregivers is that technology would be simplified to such an extent that it would "weaken a person's own abilities". By employing Mihailidis et al.'s approach to personalisation, the concerns of the caregivers would be alleviated.

The major downfall with the current user interface guidelines provided by the W3C WAI is the lack of flexibility and their apparent "one-size-fits-all" approach to design. The variability in the effects of dementia means that this approach to interface design will not work for this demographic. Flexibility is perceived as a crucial design requirement [5, 15] to ensure the interface is appropriate for the user, but could in turn become a hindrance should the person living with dementia be able to manually change the settings [5].

#### 4.2 User Acceptance

User acceptance can be considered a critical success factor for projects to implement assistive technologies [18]. This concept can be split into two sections: user experience and technology adoption. These two aspects are inherently linked. If the interface does not provide a pleasurable interaction experience, the user will be less inclined to maintain usage. An engaging interaction experience will encourage users to adopt novel technologies, which could lead to acceptance of the device into everyday usage.

People living with dementia and their caregivers are more likely to adopt a novel technology if they perceive a need requiring support [5, 17, 20]. This increased interest remains regardless of whether the users encountered difficulties which required further explanations from supervisors [20]. However, Rosenberg et al. [5] are keen to

point out that the potential users still need to experience the current need for the technology. In addition, the technology would need to seamlessly integrate within the person with dementia and their caregiver's existing habits [5, 15].

Previous experience of computing is also an important consideration for user acceptance. Research by deSant'Anna et al. [21] suggests that older users are reluctant to make use of IT through fear of causing irreparable damage to the system. This anxiety could jeopardise the effective use of the technology, negating its possible benefits [21]. In addition, the cognitive decline associated with dementia could diminish the person's ability to learn and retain the information required to operate the technology. This effect is enhanced when follow-ups and supported practice sessions are not implemented, increasing the likelihood of the technology being abandoned, despite an on-going need for continued use [22].

Both Aloulou et al. [18] and Starkhammar & Nygard [22] argue that acceptance would be lower for people in the earlier stages of the dementia progression, when the perceived need is lower and higher in people whose abilities have significantly declined. Whilst people with a higher cognitive ability would find learning new interfaces easier, they may believe that they have no requirement for the system and therefore, may find the system (and the suggestion of implementation) both patronising and stigmatizing [10].

Self image plays an important part in the adoption and acceptance of assistive technology [5, 17]. Karlsson et al. [17] found that people with dementia utilised the devices in a fashion which complemented their own self images. If the use of the device did not fit in with their preconceived image they lost interest in using the technology.

Another important factor to consider when discussing technology adoption for people living with dementia is the influence of their caregivers. Research conducted by Karlsson et al. [17] suggests that spousal support for the integration of technology has an important influence over the person living with dementia's acceptance of novel devices. Whilst research carried out by both Hwang et al. [15] and McKenzie et al. [12] suggests that whilst caregivers are supportive of new technology aimed at reducing the burden of caring, they are reluctant to adjust their responsibility to the maintenance of the new systems. In addition, caregivers are reluctant to provide support for new technologies which were either inconvenient or gave their home an "institutional" feel [12]. By avoiding assistive technologies which have an institutional look, the caregivers may be helping the person with dementia to maintain their own self-image and esteem.

## 5 Conclusion

In the last six years (January 2008 - December 2013) there has been minimal research focusing exclusively on ensuring interfaces are dementia-friendly. With the increasing number of people being diagnosed with the condition, this is a surprising conclusion. The increased prevalence of technology has the potential to provide multiple benefits, including enhanced independence and delaying the need for residential care.

However, if the interfaces are not conducive to use by people living with dementia, the users may not be able to utilise assistive technologies to their full potential.

The research does, however, suggest that considering both personalisation and user acceptance is required to make an interface dementia-friendly. Due to the diverse nature of dementia, personalisation is particularly important for this demographic. By ensuring the interface adapts to the individual user's current circumstances, the interface would increase the accessibility and usability of the application. In addition, a dynamically adapting interface will allow the users to continue utilising the technology despite facing a progressive decline in their cognitive ability.

### 5.1 Limitations

This study has a number of limitations which will be addressed in future research.

Firstly, this study only includes papers which have been published in the last six years, between January 2008 and December 2013. As such, it will not include relevant papers which have been published in the preceding years. By including these articles increased awareness of the problems associated with utilising technology whilst living with the symptoms of dementia could be sought.

Secondly, people living with dementia also experience the natural effects of ageing [16]. Through the exclusion of articles which do not relate to dementia directly, this study has neglected to investigate important factors related to ageing which will also affect interaction with technology. The inclusion of research focused on the effects of ageing will serve to enhance the knowledge of impairments experienced by people living with a dementia diagnosis.

Finally, this study only included research where interaction with technology by people living with dementia is the main focus of the article. However, there are some studies where the main focus is on the use of technology and the design implications only briefly discussed. Through the inclusion of these studies, additional insights into interaction needs could be incorporated.

### 5.2 Future Research

The overall aim of the research, which includes this study, is to develop a set of guidelines with the goal of aiding interface designers to make interaction with technology dementia-friendly. This will allow the researchers to develop a smart application designed to be utilised by people living with dementia and their caregivers. The adherence to the developed set of guidelines will aim to ensure the application can be used to its full potential.

Further relevant articles, which are outside the January 2008 to December 2013 publication date range will be obtained through the reference harvesting (or snowballing) technique. This will ensure that earlier research will be included within the developed guidelines. As part of this process, additional relevant search terms will be added to the list of keywords.

Finally, additional searches of the literature will be conducted to include additional keywords such as: older, elderly ageing and aged. These searches will inform the

guidelines and allow them to take into account the natural effects of ageing. In addition, considering the interface needs of older people will aid interaction with the developed smart application for the caregiver of the person living with dementia.

## References

1. World Health Organisation, <http://www.who.int/mediacentre/factsheets/fs362/en/>.
2. Alzheimer's Society, <http://www.alzheimers.org.uk/infographic>.
3. Alzheimer's Society, [http://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=106](http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=106).
4. Alzheimer's Society, [http://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=133](http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=133).
5. Rosenberg, L., Kottorp, A., Nygard, L.: Readiness for Technology Use with People with Dementia: The Perspectives of Significant Others. *Journal of Applied Gerontology*, 31, 510-530 (2012).
6. Rosenberg, L., Kottorp, A., Winblad, B., Nygard, L.: Perceived Difficulty in Everyday Technology Use Among Older Adults With or Without Cognitive Deficits. *Scandinavian Journal of Occupational Therapy*, 16, 216-226, (2009).
7. Chou, J., Hsiao, S.: A Usability Study on Human-Computer Interface for Middle-aged Learners. *Computers in Human Behavior*, 23, 2040-2063 (2007).
8. Ziefle, M.: Information Presentation in Small Screen Devices: The Trade Off between Visual Density and Menu Foresight. *Applied Ergonomics*, 41, 719-730 (2010).
9. Alzheimer's Society, [http://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=109](http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=109).
10. Nijhof, N., van Gemert-Pijnen, J., Burns, C., Seydel, E.: A Personal Assistant for Dementia to Stay at Home Safe at a Reduced Cost. *Gerontechnology*, 11, 469-479 (2013).
11. Skillen, K., Chen, L., Nugent, C., Donnelly, M., Solheim, I.: A User Profile Ontology Based Approach for Assisting People with Dementia in Mobile Environments. In: 34<sup>th</sup> Annual International Conference of the IEEE EMBS, pp 6390-6393 (2012).
12. McKenzie, B., Bowen, M., Keys, K., Bulat, T.: Safe Home Program: A Suite of Technologies to Support Extended Home Care of Persons with Dementia. *American Journal of Alzheimer's Disease and Other Dementias*, 28, 348-354 (2013).
13. Mihailidis, A., Blunsden, S., Boger, J., Richards, B., Zutis, K., Young, L., Hoey, J.: Towards the Development of a Technology for Art Therapy and Dementia: Definition of Needs and Design Constraints. *The Arts in Psychotherapy*, 37, 293-300 (2010).
14. Carrillo, M., Dishman, E., Plowman, T.: Everyday Technologies for Alzheimer's Disease Care: Research Findings, Directions and Challenges. *Alzheimer's & Dementia*, 5, 479-488 (2009).
15. Hwang, A., Truong, K., Mihailidis, A.: Using Participatory Design to Determine the Needs of Informal Caregivers for Smart Home User Interfaces. In: 6<sup>th</sup> International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth) and Workshops, pp 41-48 (2012).
16. Ancient, C., Good, A.: Issues with Designing Dementia-Friendly Interfaces. In: Stephanidis, C. (eds.) *HCII 2013*. CCIS, vol. 373, pp 192-196. Springer, Heidelberg (2013).
17. Karlsson, E., Axelsson, K., Zingmark, K., Savenstedt, S.: The Challenge of Coming to Terms with the Use of a New Digital Assistive Device: A Case Study of Two Persons with Mild Dementia. *The Open Nursing Journal*, 5, 102-110 (2011).

18. Aloulou, H., Mokhtari, M., Tiberghien, T., Biswas, J., Phua, C., Lin, J., Yap, P.: Deployment of Assistive Living Technology in a Nursing Home Environment: Methods and Lessons Learned. *BMC Medical Informatics and Decision Making*, 13 (2013).
19. Mahmud, N., Vogt, J., Luyten, K., Slegers, K., Van den Burgh, J., Coninx, K.: Dazed and Confused Considered Normal: An Approach to Create Interactive Systems for People Living with Dementia. In: Bernhaupt, R., Forbrig, P., Gulliksen, J., Larusdottir, M. (eds.) *HCSE 2010. LNCS vol. 6409*, pp 119-134. Springer, Heidelberg (2010).
20. Gonzalez-Palau, F., Franco, M., Toribio, J., Losada, R., Parra, E., Bamidis, P.: Designing a Computer-based Rehabilitation Solution for Older Adults: The Importance of Testing Usability. *PsychNology Journal*, 11, 119-136, (2013).
21. de Sant'Anna, M., Vallet, C., Kadouche, R., Stefanucci, D., Tomascakova, A., Morat, B., Rigaud, A-S.: Computer Accessibility for Individuals Suffering from Mild to Moderate Alzheimer's Disease. *European Geriatric Medicine*, 1, 186-192 (2010).
22. Starkhammar, S., Nygard, L.: Using a Timer Device for the Stove: Experiences of Older Adults with Memory Impairment or Dementia and their Families. *Technology and Disability*, 20, 179-191, (2008).